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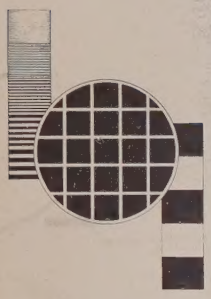

TEST ENG.
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video calibration generator

PM 5546

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9499 490 07611

730701/1/01/02

PHILIPS

MP MASTER
MA24524

PHILIPS

PHILIPS

Instruction manual

Important:

In correspondance concerning this instrument, please quote the complete type and serial number, as given on the identification plate at the rear of the instrument.

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I. Introduction

General information

The PHILIPS PM 5546 is a very accurate video source supplying a large variety of television test signals.
The instrument can be used for the alignment and calibration of different types of video equipment such as cameras, video generators, colour encoders and decoders, monitors, etc.
It is thus suitable for use in studios, continuity and switching centres, distribution systems, transmitter stations, etc.
The generator is available in two versions, viz.

PM 5546 G	for the 625 lines/50 Hz system
PM 5546 M	for the 525 lines/60 Hz system

II. Technical data

Properties expressed in numerical values with stated tolerances are guaranteed by us. Numerical values without tolerances represent the properties of an average instrument and merely serve as guide.

A. Input signals

Composite sync. and blanking signal	: 2 - 8 V_{p-p}, negative; max. permissible superimposed hum 100 %
Input impedance	: high ohmic, looped through

B. Fixed output signals

1. Colour bar signals

Versions (to be chosen by internal selection)	: 100 % contrast
	: 75 % contrast
	: 75 % contrast, 100 % white level (EBU)
	: 75 % contrast, 25 % set-up (BBC)

Any of four signals with or without a horizontal white reference bar having the same contrast as the colour bar signal.

Amplitude	: 0.70 V_{p-p} ±0.25 %
Rise and fall time	: 100 ns ± 20 ns
Step coincidence	: ⩽ 10 ns at 50 % Level

2. Grey scale signal

Version (to be chosen by internal selection)	: 6 or 11 levels
Amplitude	: 0.70 V_{p-p} ±0.5 % excl. sync. : 1.00 V_{p-p} ±0.5 % incl. sync.
Rise time	: 230 ns ±10 %
Inequality of steps	: ⩽ 0.5 %

3. Cross hatch/dot signal

Version (to be chosen by internal selection)	: 14 x 19 lines or dots
Amplitude	: 0.70 V_{p-p} ±1 % excl. sync. : 1.00 V_{p-p} ±1 % incl. sync.
Width of vertical lines	: 230 ns ±5 %
Width of horizontal lines	: 1 line per field
Position	: pattern can be shifted in horizontal and vertical direction
Dot pattern	: the dots appear at cross points of the cross hatch pattern

4. PLUGE (= picture line - up) signal

Composition	: one white and two black level bars
Amplitude	: 0.70 V_{p-p} ±0.25 % excl. sync. : 1.00 V_{p-p} ±0.25 % incl. sync.
Amplitude of black-level bars	: ±2 % of black/white level, adjustable 0 - 5 %
Rise and fall time	: 230 ns ±10 %

5. White reference pulse

Width of white pulse	: 10 μs ± 0.5 μs (adjustable)
Amplitude	: 0.70 V_{p-p} ±0.25 % excl. sync. : 1.00 V_{p-p} ±0.25 % incl. sync.
Rise and fall time	: 100 ns ± 10 ns

C. RGB Output signals ("SWITCHED OUTPUT")

Selection by means of push-button

1. Colour bar signal, sub. b-1
2. Grey scale signal, sub. b-2
3. Crosshatch/signal, sub. b-3
4. Dot signal, sub. b-3
5. PLUGE signal, sub. b-4
6. Black signal with ±2 % bars Like PLUGE signal
7. White signal, amplitude 0.70 V_{p-p} ±0.25 %
8. Red signal, amplitude 0.70 V_{p-p} ±0.25 %
9. B-Y signal and R-Y signal
   RGB signal giving the colour difference signals prior to encoding.

Composition	: 26 μs of (B-Y) followed by 26 μs of (R-Y)	
Amplitude (B-Y)	: R = 0.1099 V_{p-p}, G = 0, B = 0.7000 V_{p-p}	±0.25 %
Amplitude (R-Y)	: R = 0.7000 V_{p-p}, G = 0, B = 0.2359 V_{p-p}	

D. Remote control

The selection of the various signals at the switched output can be done by push buttons at the front or by remote control via multiplug at the rear (+5 V logic).

E. Temperature range

Operating conditions	: 0 - 50 °C

The stated tolerances are guaranteed for ambient temperatures of 20 - 40 °C.
Outside this range the tolerances are twice the stated figures.

F. Power supply

Mains voltage	: 115/230 V ±20 %
Mains frequency	: 48 - 65 Hz
Power consumption	: 45 W at 220 V
Fuse	: For 115 V range: 600 mA, delayed action For 230 V range: 300 mA, delayed action

G. Mechanical data

Width	: 3/6 module in PHILIPS universal 19" system
Height	: 132 mm (3 units)
Depth	: 435 mm
Weight	: 5.0 kg (without cabinet)

III. Accessories

1 Operating manual
1 Mains flex
10 Terminating plugs 75 Ω, 0.1 %
2 Terminating plugs 75 Ω, 1 %
2 Extension boards, enabling measurements in the instrument when it is in operation.

N.B. The PM 5546 is delivered without cabinet.
A 3/6 module cabinet can be ordered with typenumber PM 9713.
The generator can also be accomodated together with another 3/6 module instrument in a 6/6 module cabinet PM 9716A.

IV. Description of the block diagram

The generator can in principle be divided into 3 parts:

1. The "Pulse generator" which is generating the control pulses for the "Test picture generators".
2. The "Test picture generators" with "Switchable output".
3. The "Test picture generators" with "Fixed outputs".

1. "Pulse generator

a. Sync. and blanking inputs

The generator is synchronized by the applied sync. and blanking signals.
These signals can be supplied from a TV sync. generator i.e. PM 5530, PM 5531 or PM 5532.

The "Input amplifiers" amplify and reshape the blanking and sync. signals, supplied from the TV pulse generator. The amplifiers have high input impedances and they deliver pulses which are independent of the amplitude of the applied input pulses.
Two pulse separating circuits separate the line and field pulses out of the complete sync. signal.

b. Horizontal pulse system

All horizontal information is derived from a phase-locked oscillator running at a frequency of approx. 1.4 MHz.
The line pulse f_H is applied to the oscillator "start/stop circuit" (f_H*) via the two one-shots.
The one-shots are delaying the start of the oscillator and consequently all horizontal timing (information).

The delay can be adjusted by means of R1 "HORIZONTAL POSITION".
The "Oscillator" is supplying the clock pulses to the pulse generators (72 pulses per line).

The "Frequency control" is a phase discriminator which compares the "end of counting" point with the line pulses, so if the counter has not finished its job during the 64 μs of a line period the frequency of the clock oscillator is automatically increased and vice versa.

The circuit neutralizes any frequency drift in the oscillator both versus temperature and ageing.
The "Staircase control" is supplied with the clock pulses via a 12:1 divider (11 levels staircase).
The "Staircase control" is generating the control pulses (a, b, c and d), being applied to the "Staircase generators" in the "Test picture generators".
The "Colour bar generator" is supplied with clock pulses via a 9:1 divider (the two 3:1 dividers).

The "Colour bar generator" is generating the control pulses R, G and B being applied to the red, green and blue colour bar generators in the "Test picture generators".
The "Start/stop circuit" is controlling both the "Colour bar generators" and the "Staircase control" (by means of the α and ω pulses).

The control signals f, g, h and i, applied to the PLUGE generators, are generated in three one-shots and the "4:1 divider".
Two of the one-shots are triggered by the line pulse $\overline{f_H}$*.
The "4:1 divider" is controlled by the line pulse $\overline{f_H}$*, the 11 μs delayed pulse and the applied clock pulses.
The vertical lines V_L are generated in a 260 ns one-shot which is triggered by the clock pulses via another "4:1 divider".
The vertical lines are used together with the horizontal lines H_L in the "Crosshatch-dots generators."

c. Vertical pulse system

The horizontal lines of the crosshatch are derived from the "Vertical divider" (21:1 divider) which counts the line pulses.
The delayed field drive pulse is controlling the counter in such a way that the first line in the field appears at the proper place.

The delayed field pulse is obtained by means of the "166 μs OS" and the "Vertical delay".
The delay can be shifted ±7 lines by means of SK12 "VERTICAL POSITION" and in this way adapt the grid pattern to the field blanking signal.

2. "Test picture generators" with "Switchable output"

The generators are controlled by the signals from the "Pulse generator".
The respective patterns are supplied as R-G-B signals to the respective output filters.

a. Colour bar generator

At delivery the generator will supply a standard colour bar.
By changing the position of the jumpers at the printed wiring board (see chapter VII) various colourbars may be supplied.

Additionally it is possible to add a horizontal white reference bar. This bar coming from the "Horizontal white bar generator" can also be added by changing the jumpers at the printed wiring board.

b. Staircase generator

At delivery the generator will supply an 11 levels grey scale.
A 6 levels grey scale can be obtained by changing jumpers at the printed wiring boards (see chapter VII).

c. Output circuits

The output amplifiers are in principle digital to analog converters.
To satisfy the demand of level stability (0.25 %) these converters are constructed as shown in fig. IV-1.

The circuit consists of a constant current generator TS2 and a switch TS1. The output voltage can thus be either zero or I x 75 V, where I is the constant current (I in Amps, 75 is the 75 Ω resistor.).
The realization of the multi-level signals (grey scale) requires extra current generators in parallel.

The filter at the output shapes the waveform to a specific rise time (Besset filter).
The filter shapes the voltage transients into the required rise- and fall times.

d. Remote control

All the switch functions of the "Switchable output" can be remotely controlled via the multiplug BU17 (+5 V logic) (see chapter V).

3. "Test picture generators" with "Fixed outputs"

The generators are similar to those at the "Switchable output", but each of the generators has its own output.
Apart from the colour bar the output signals are supplied as monochrome signals.

The output circuit is the same as in the switchable output generators with the exception of the filter specifications for the grey scale and PLUGE signals (250 ns instead of 100 ns).

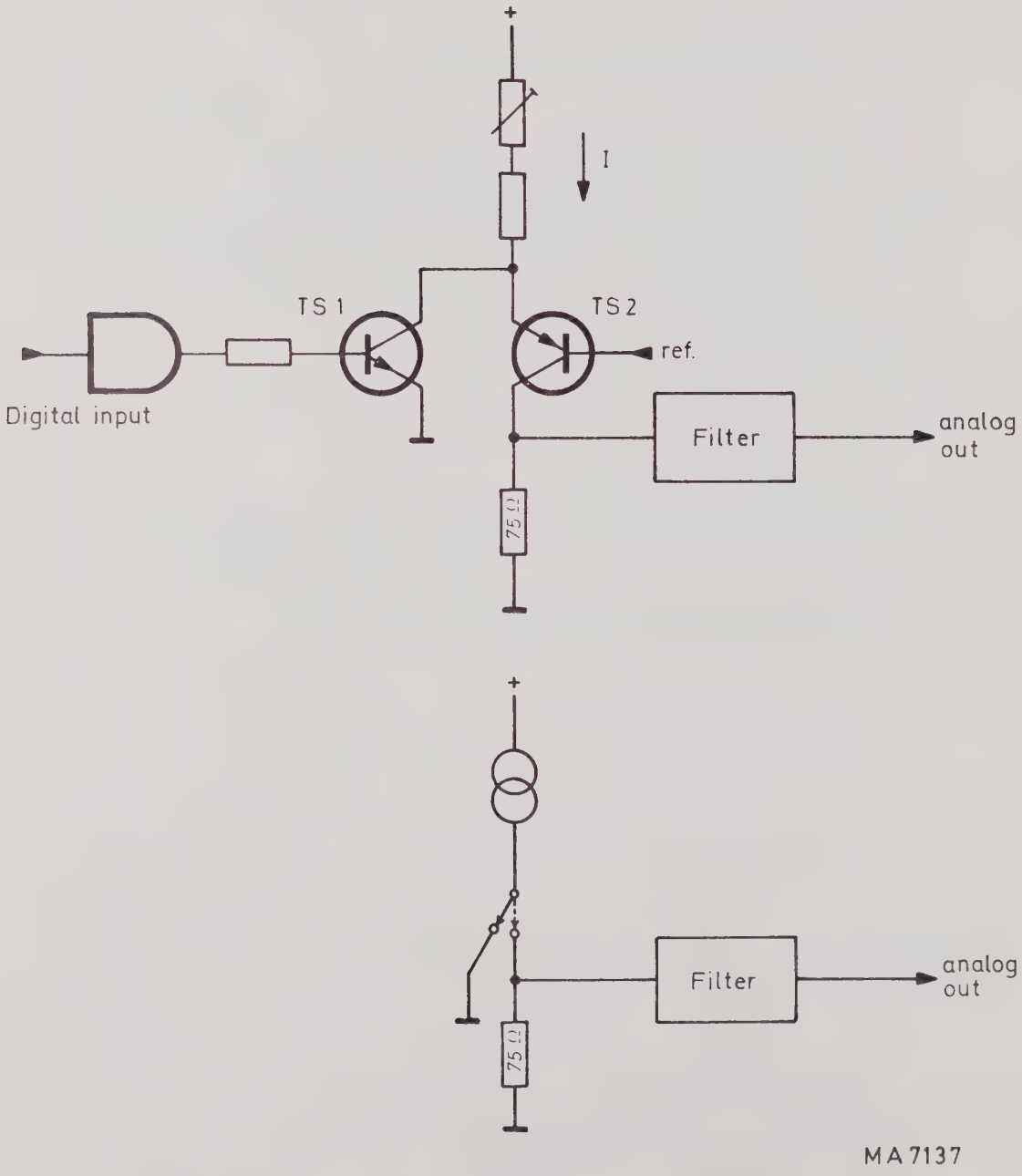


Fig. IV-1. Simplified diagram Output amplifier

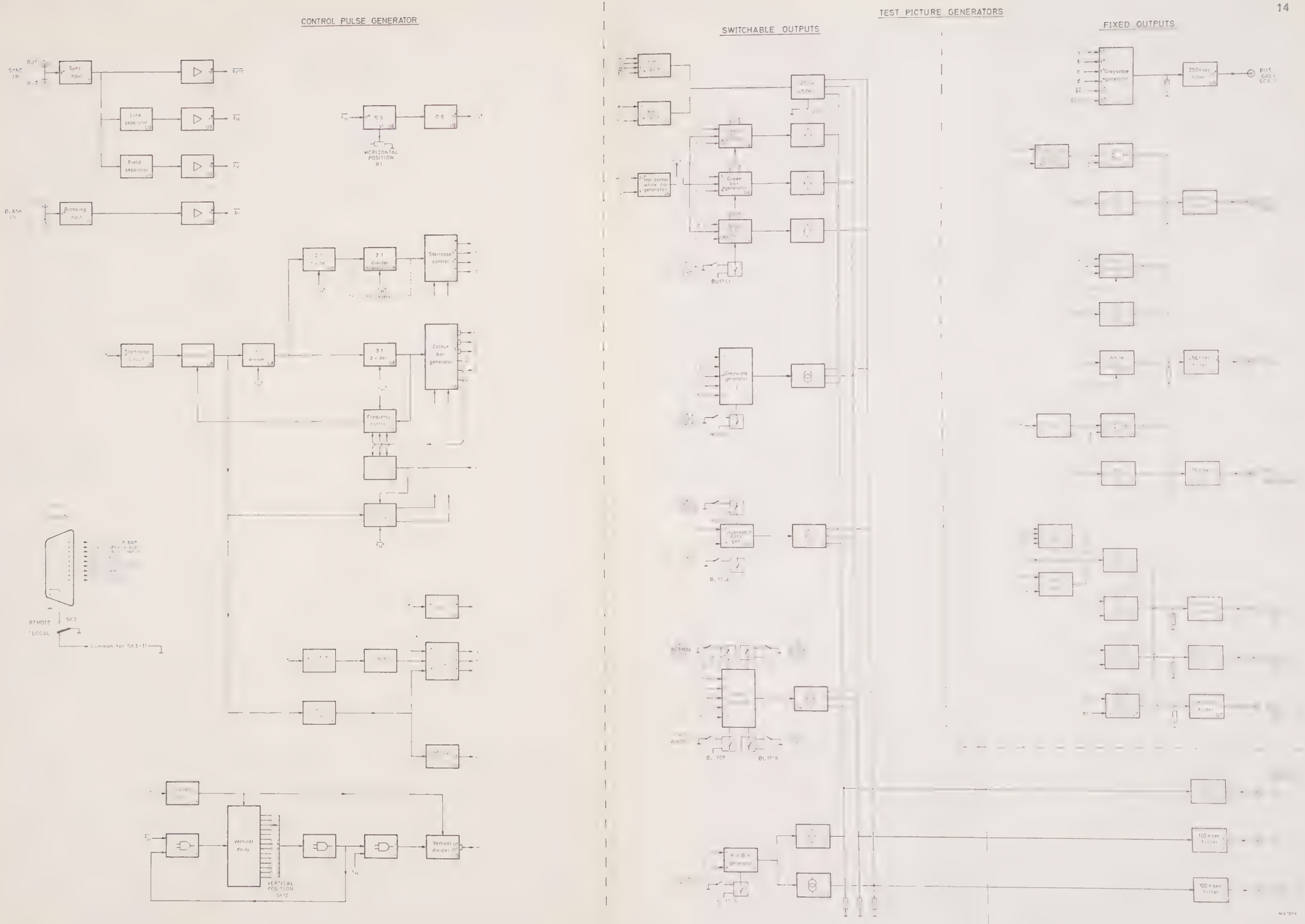


Fig. IV-2. Block diagram

V. Installation

A. Adjusting to the local mains voltage

The instrument can be used with mains voltages of 115 V and 230 V a.c. ±20 %.
Before using a new instrument check the adjustment.
If the instrument has to be adjusted to another mains voltage, resolder the connections to the primary windings of the supply transformer as shown in the figures below.

Fig. V-1. Adjusting to the local mains voltage

B. Earthing

Earth the instrument in accordance with the local safety regulations.
The metal cabinet can be earthed via socket BU18 (see fig. VI-2) and via the earthing core of the mains flex.
The electrical circuit can be earthed via socket BU19 (see fig. VI-2) and via the screening of the coaxial connection cables.
Avoid double earthing of the electrical circuit, because this may introduce hum phenomena.

C. Mounting in a cabinet

The instrument can be mounted either in a 3/6 module cabinet PM 9713 or, together with another 3/6 module instrument, in a 19" cabinet PM 9716 (6/6 module).
The mounting instructions are delivered with the cabinet.

D. Multiplug

If the instrument should be remote-controlled the generator has to be connected with the remote control unit via the multiplug at the rear.
Switch SK2 has to be placed in position "REMOTE" any push-button function can now be put in operation by connecting the corresponding terminal on terminal 23 (see Fig. V-2).

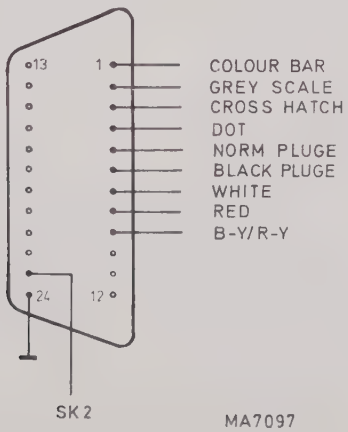


Fig. V-2. Multiplug remote control

VI. Survey of controls and sockets

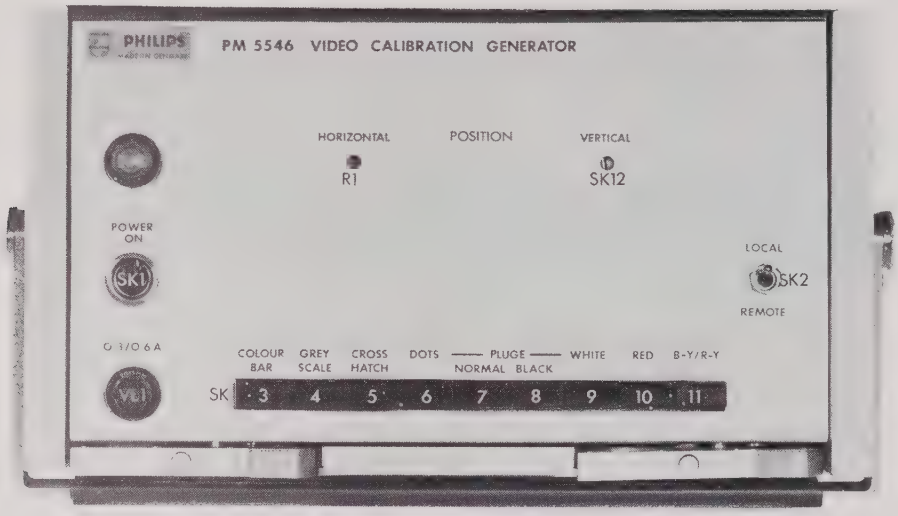


Fig. VI-1. Front of the instrument

A. Front of the instrument

LA1	Pilot lamp; lights up when the instrument is switched on.
SK1	"POWER ON" Mains switch; the instrument is switched on if the lever of the switch is placed upwards.
SK2	"LOCAL-REMOTE" Switches over the selection of the various signals by push button to remote control, and vice versa.
SK3	"COLOUR BAR" When pressed the "switched output" supplies the colour bar signal.
SK4	"GREY SCALE" When pressed the "switched output" supplies the grey scale signal.
SK5	"CROSS HATCH" When pressed the "switched output" supplies the cross hatch signal.
SK6	"DOTS" When pressed the "switched output" supplies the dots signal.
SK7	"PLUGE-NORMAL" When pressed the "switched output" supplies the normal PLUGE signal.
SK8	"PLUGE-BLACK". When pressed the "switched output" supplies the black PLUGE signal.
SK9	"WHITE" When pressed the "switched output" supplies the white signal.
SK10	"RED" When pressed the "switched output" supplies the red signal.
SK11	"B-Y/R-Y" When pressed the "switched output" supplies the colour difference signals.
SK12	"POSITION VERTICAL" 15 positions rotary switch controlling vertical position of all the patterns (screwdriver controlled).
R1	"POSITION HORIZONTAL" Potentiometer controlling horizontal position of all the patterns (screwdriver controlled).
VL1	Safety fuse: 220 V - 300 mA, delayed action type 110 V - 600 mA, delayed action type

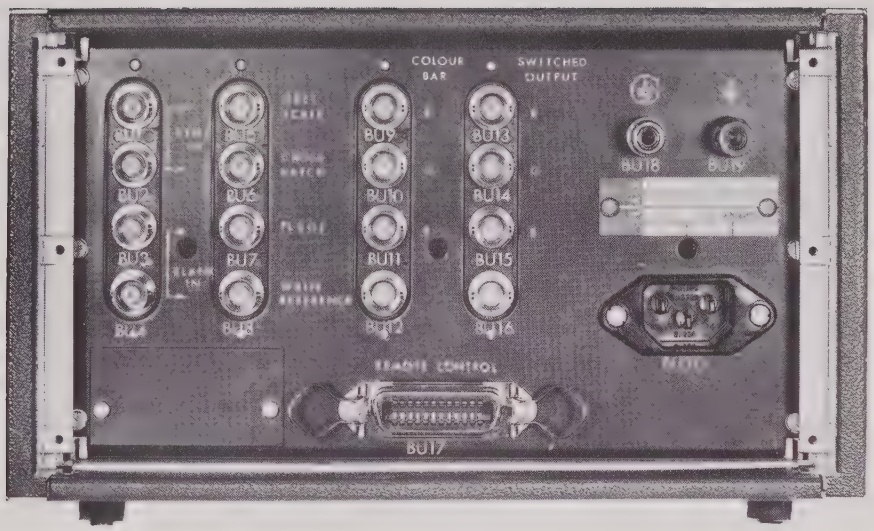


Fig. VI-2. Rear of the instrument

B. Rear of the instrument

BU1, BU2	"SYNC. IN" Looped through input sockets for the composite sync. signal.
BU3, BU4	"BLANK IN" Looped through input sockets for the composite blanking signal.
BU5	"GREY SCALE" Output socket for the grey scale signal.
BU6	"CROSS HATCH" Output socket for the cross hatch signal.
BU7	"PLUGE". Output socket for the normal PLUGE signal.
BU8	"WHITE REFERENCE" Output socket for the white reference signal.
BU9, BU10, BU11	"COLOUR BAR RGB" Output sockets for the colour bar signal.
BU13, BU14, BU15	"SWITCHED OUTPUT RGB". Output sockets for the signals selected by push-button at the front of the instrument or by remote control.
BU17	"REMOTE CONTROL". Multiplug to facilitate a remotely controlled selection of the signals at the "switched output".
BU18	" ⏚ ". Earthing socket connected to the metal cabinet.
BU19	" ⏚ ". Earthing socket connected to the electrical circuit.
BU20	Mains socket.

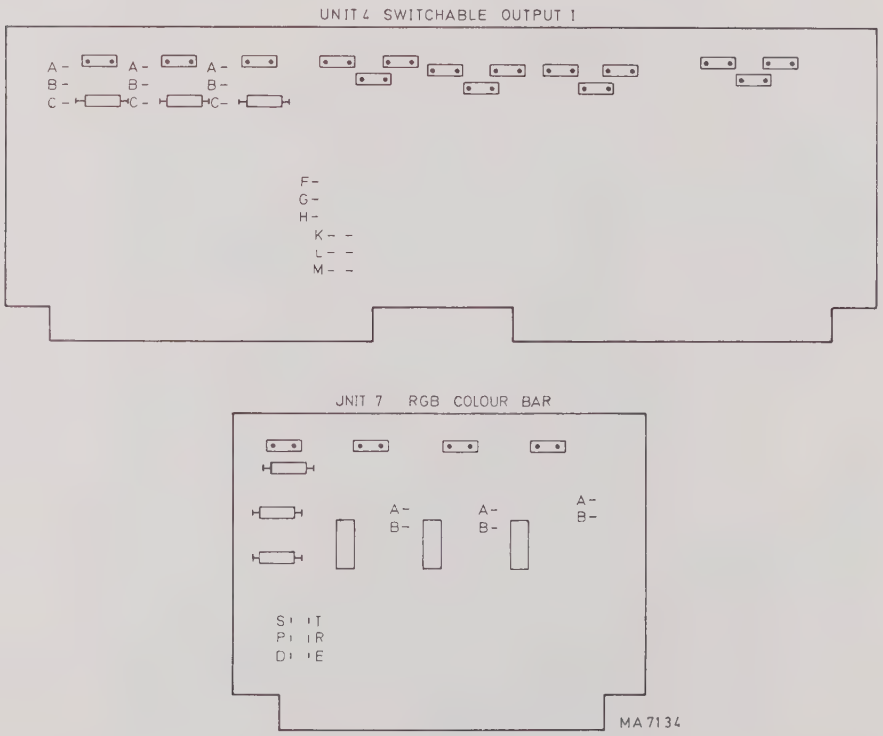
VII. Modifications

a. Colour bar

The generator can supply four different colour bars:

1. 100 % contrast
2. 75 % contrast
3. 75 % contrast, 100 % white (EBU)
4. 75 % contrast, 25 % set-up (BBC)

Each of these colour bars can be obtained by resoldering the jumpers on printed wiring boards according to the figures below. (Fixed colour bar output: unit 7; switched output: unit 4).



1	100 % contrast	Interconnect points	A - B , D - E , G - H
2	75 % contrast	Interconnect points	B - C , D - E , F - G
3	75 % contrast , 25 % set-up (BBC)		F - G , K - L , S - T
4	75 % contrast , 100 % white (EBU)		F - G , L - M , P - R

Fig. VII-1. Colour bar selection

b. White reference bar

The colour bars can be supplied with a white reference bar, having the same contrast as the colour bar signal. To obtain the white reference bar a connection has to be made on the printed wiring boards according to the figure below.

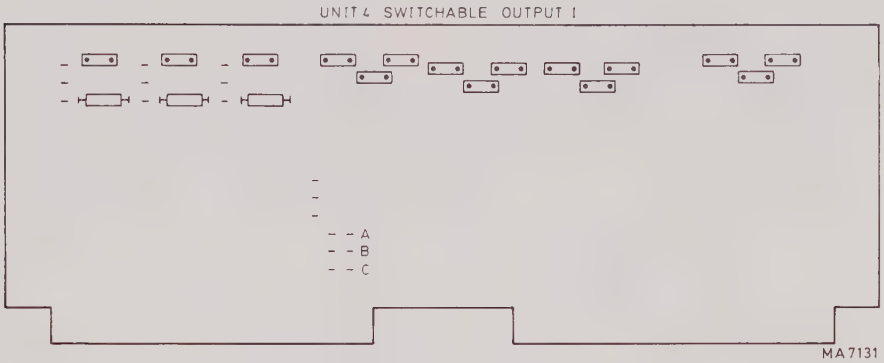

UNIT 4 SWITCHABLE OUTPUT 1
A
B
C
MA 7131
With white ref bar Interconnect points A - B
Without white ref bar Interconnect points B - C

Fig. VII-2. With/without white reference bar

c. Crosshatch/dot

The fixed output at BU6 can be either a crosshatch- or a dot signal.
The selection has to be made by resoldering the jumpers on printed wiring board 3 (See Fig. VII-3).

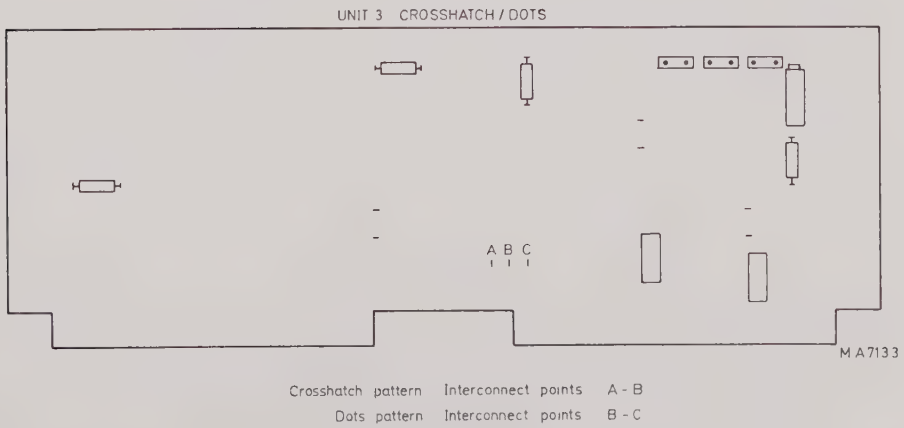


Fig. VII-3. Crosshatch/dot selection

VIII. Service instructions

In the following chapters the circuitry of the units has been explained.
The service adjustments, if any, have been described at the end of the chapter concerned.

Please bear in mind the following notes:

- The unit to be checked or adjusted, should be placed on an "Extension board", delivered with the instrument.
- The tolerances mentioned, are factory tolerances which apply when readjusted the instrument. They may differ from those shown in section "General information" chapter II "Technical data".
- The voltages shown in the diagram and the oscillograms published have been measured with respect to terminal 22 in a PM 5546 connected to 220 V.
- The d.c. voltages have been measured with a PHILIPS d.c. voltmeter PM 2441.
- The oscillograms have been measured with a PHILIPS oscilloscope PM 3250 in combination with a PHILIPS TV sync. separator probe PM 9347.
- The oscillograms have been photographed with a PHILIPS camera outfit PM 9380.
- Before making adjustments, the instrument should have been switched on for more than 15 minutes.
- The diagrams are provided with figures for reference; 27 in the diagram for example, refers to oscillogram no. 27.

N.B. Switch off the mains when exchanging printed wiring boards.

A. Common adjustments

The units 1 to 9 have so-called common adjustments which secure the correct amplitude and level ratio of the output signals.
These adjustments are numbered and attention should be paid that all these adjustments must be carried out and in the given sequence.

unit 1: voltage regulator
unit 9: sync. regenerator
unit 8: horizontal divider
unit 6: Grey scale
unit 7: RGB colourbar
unit 3: Cross hatch-dots
unit 2: pluge
unit 4: switchable output I
unit 5: switchable output II

In case of fault finding or adjustments make sure that the sync. and blanking pulses from unit 9 are present with the right amplitude and shape.
On Fig. VIII-1, a survey of adjusting elements are stated, enabling to make some adjustments without using the extension board.

B. Pulse level adjustments

Chopper set-up

The pulses have been adjusted very accurately at the factory.
Re-adjustment should only take place if absolutely necessary, because it might be very difficult to obtain the required accuracy.
It is recommended that the Philips Video level meter PM 5548 is used in order to ensure accurate adjustment.
In case the PM 5548 is not available a special chopper set-up must be used as shown in Fig. VIII-2.

Measuring equipment for chopper set-up:

Digital voltmeter: e.g. PHILIPS PM 2441
Oscilloscope : e.g. PHILIPS PM 3250

Adjustment by using the chopper set-up

1. Adjust the chopper potentiometers (R5-R6) to obtain a 0.000 V reading on the digital voltmeter.
2. Set the oscilloscope sensitivity to 5 mV/cm.
3. Compare the 0.000 V line on the oscilloscope with 0 V from the unit which has to be adjusted and notice the difference if any.
4. Turn the chopper potentiometers until the digital voltmeter reading is the same as the level desired for the pulse being adjusted.
5. Set the oscilloscope sensitivity to 0.2 V/cm.
6. Adjust the relevant potentiometer (in the instrument) until the pulse-level being adjusted equals the d.c.-level (reading as in section 4) as shown in the figures as in checking and adjusting by using the video level meter PM 5548.
7. Repeat section 6 with the oscilloscope sensitivity set at 5 mV/cm and make appropriate correction for the different 0 V-levels mentioned in section 3.

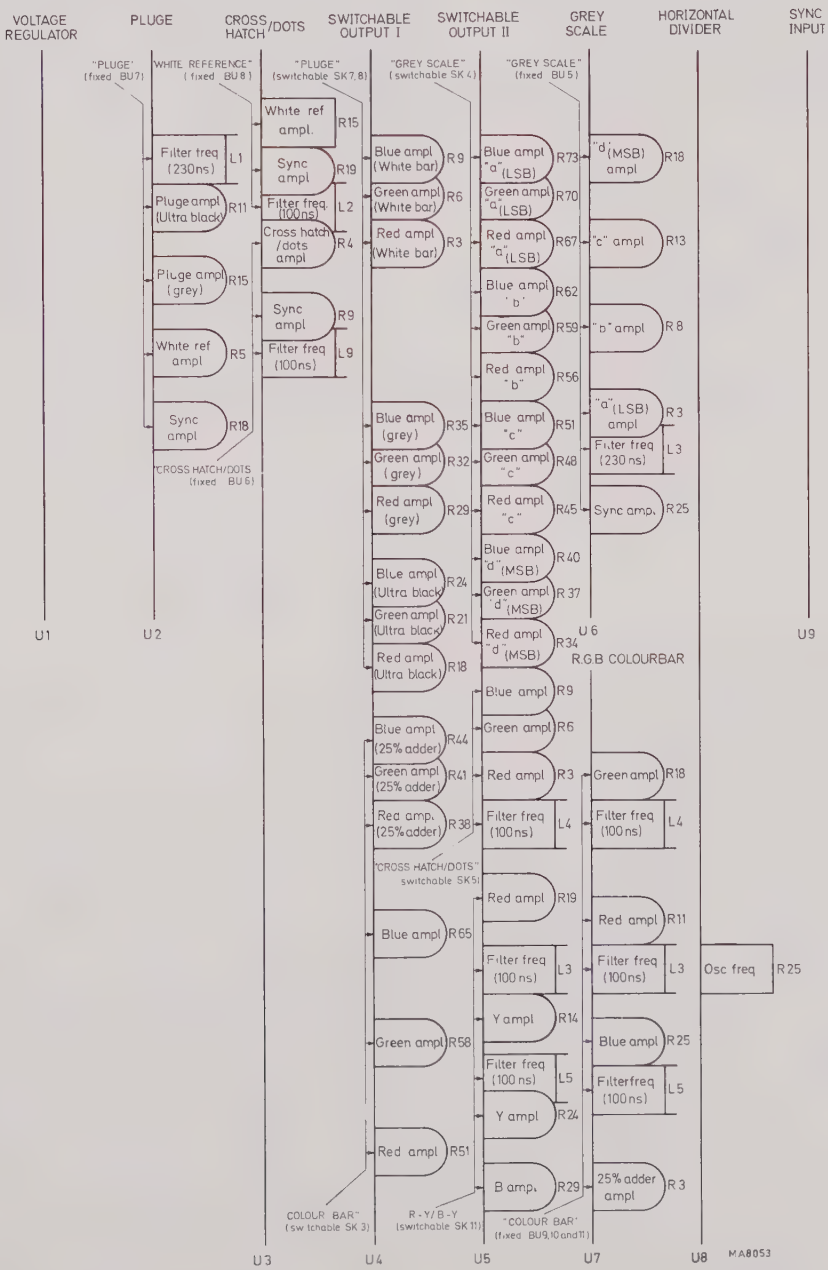
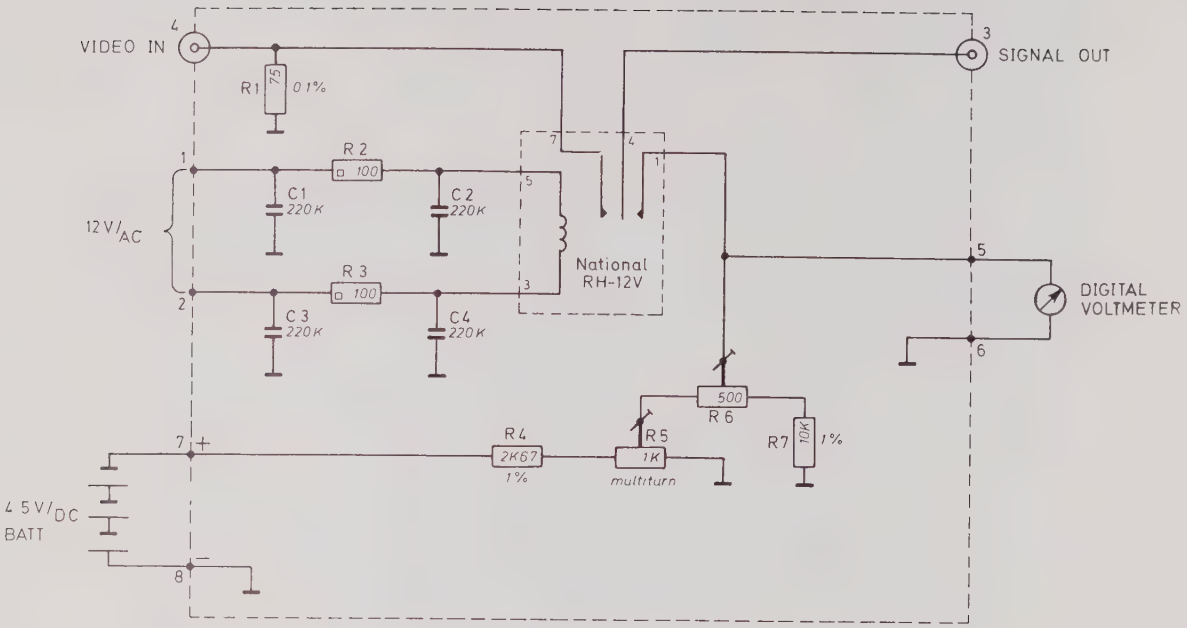


Fig. VIII-1. Adjusting survey



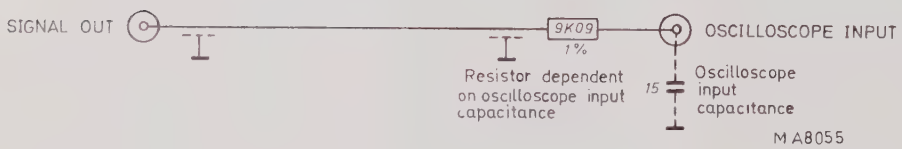
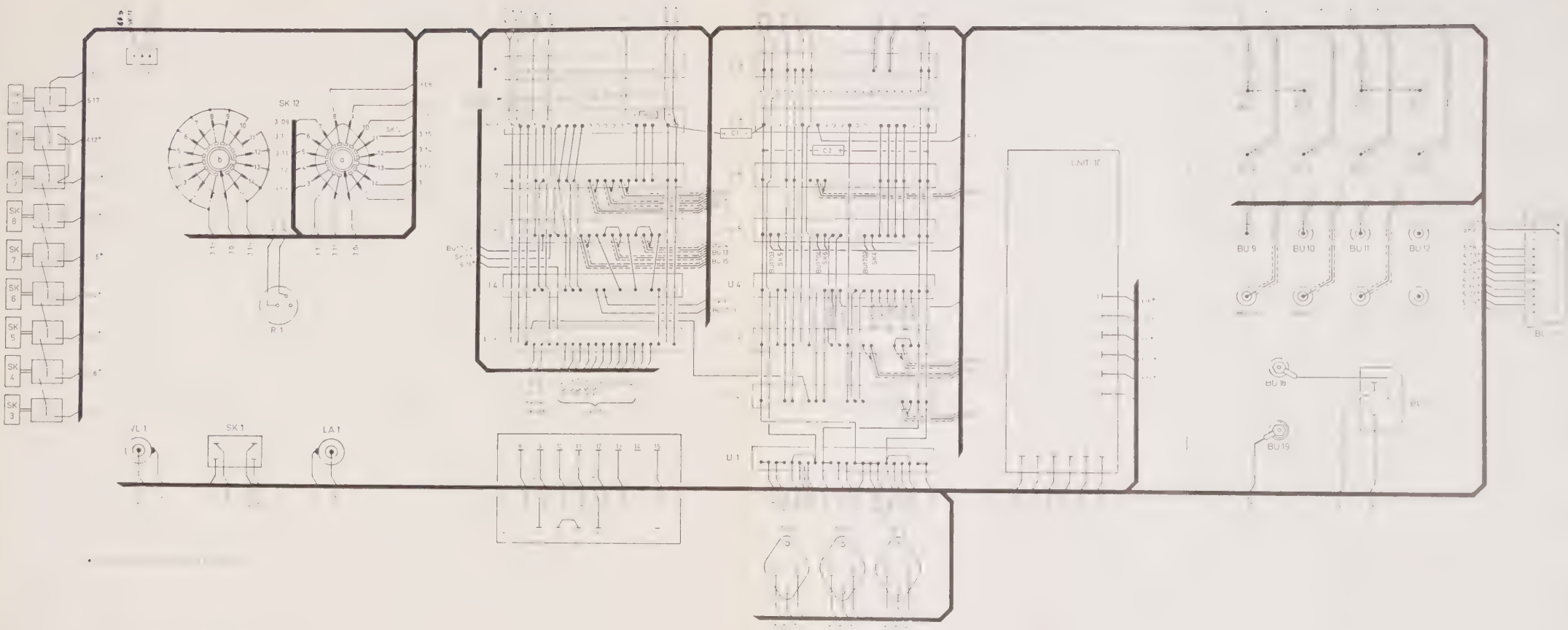
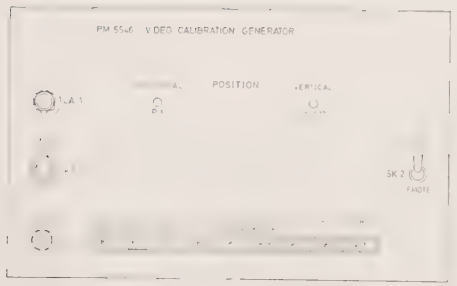
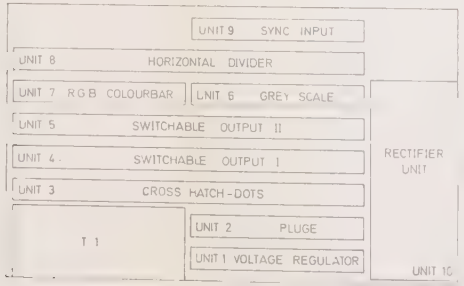


Fig. VIII-2. Circuit diagram, chopper set-up







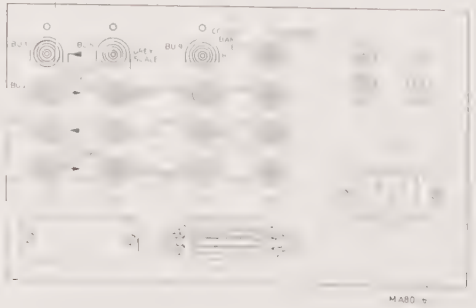


Fig. VIII-3. Wiring diagram

IX. Unit 1-10, power supply

The voltage regulator unit 1 supplies three stabilized d.c. voltages: +15 V, +5 V and −10 V. The regulator contains also circuits protecting against short circuits between any of the d.c. voltages and earth.

The reference voltage for the stabilizing circuits is obtained from the zener diode GR104 (the junction GR104/R118 + R136 is adjusted to 5.2 V giving low temperature drift).

The zener-stabilized +5 V voltage is used as a reference voltage for the +15 V, which in turn is used as a reference voltage for the −10 V and as the supply voltage for the zener diode.

The current limiting circuits are:

for +15 V: TS102 - R111 (limiting at 600 mA)
for + 5 V: TS106 - R123 (limiting at 1.6 A)
for −10 V: TS110 - R133 (limiting at 700 mA).

If a short circuit occurs, the current limiting circuits will switch off the +15 V and consequently all three voltages will be stopped.

A short circuit of any of the three voltages will be indicated by the power indicator lamp LA1 going out.

The current limiting circuits must be disconnected while servicing the power supply. This can be done by removing point A from B and point C from D. Point D should then be connected to an external: 15 V source.

Checking and adjusting

Measuring equipment:

Digital voltmeter: e.g. PHILIPS PM 2441
Oscilloscope : e.g. PHILIPS PM 3250

+5 V d.c.

Connect the voltmeter to terminal 3* (earth at terminal 9*).
The voltage should be +5 V ±0.05 V.
If not, check the voltage at TS108/R138.
This voltage should be +5.2 V $^{+0}_{-0.1}$ V
Select if necessary R136 (> 820 Ω) for the correct voltage.
Reconnect the voltmeter to terminal 3* and select if necessary R120 (0-100 kΩ) until the +5 V ±0.05 V is obtained.

+15 V d.c.

Connect the voltmeter to terminal 13* (earth at terminal 9*).
The voltage should be +15 V ±0.01 %.
If the voltage is too low, connect a resistor (within 400 kΩ - 1 MΩ) parallel to R108.
If the voltage is too high, connect a resistor (within 400 kΩ - 1 MΩ) parallel to R106.

−10 V d.c.

Connect the voltmeter to terminal 18* (earth at terminal 9*).
The voltage should be −10 V ±0.5 %.

Ripple voltages

Connect oscilloscope to terminals 3*, 13* and 15* respectively.
The 100 Hz ripple voltage must not exceed 1 $mV_{p\text{-}p}$.

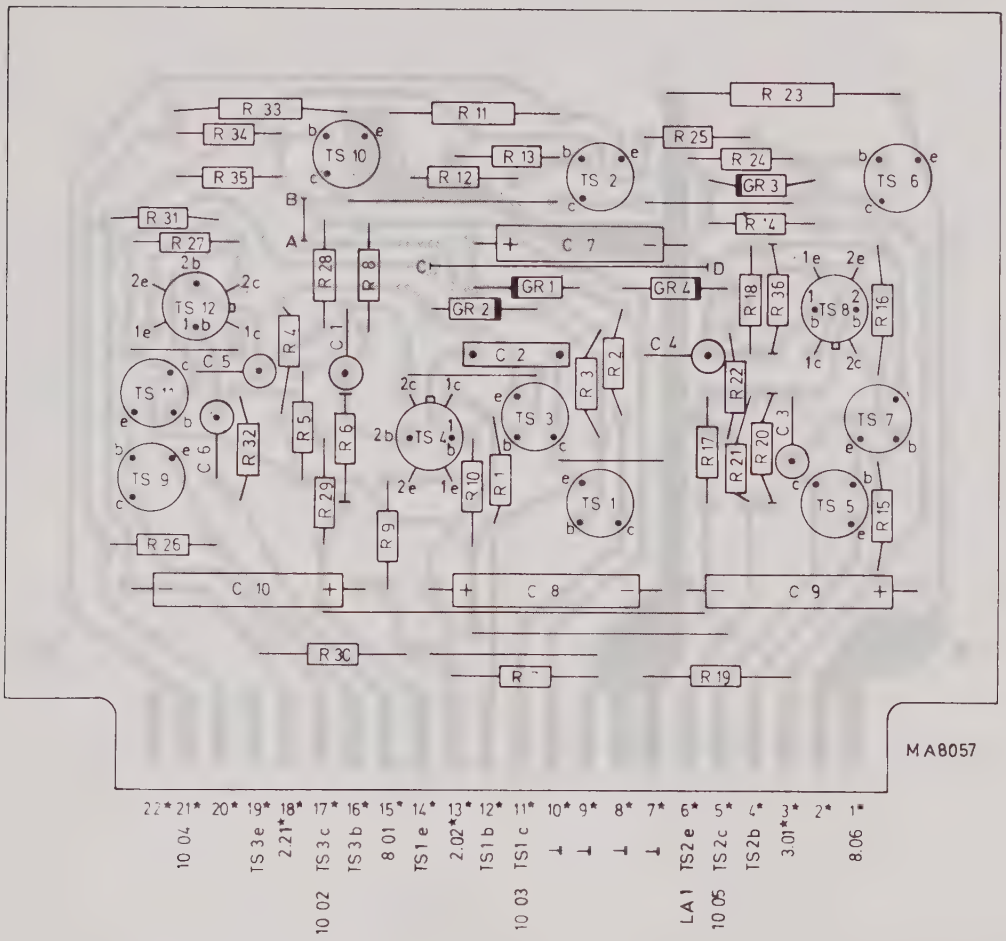


Fig. IX-1. Printed wiring board, voltage regulator, unit 1

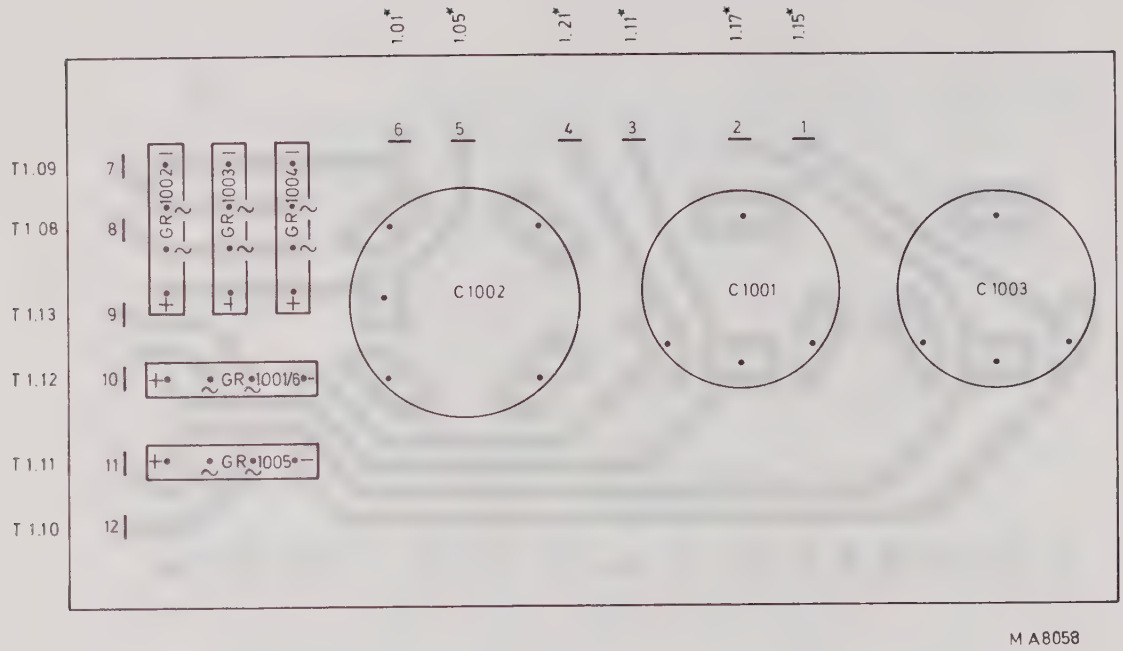


Fig. IX-2. Printed wiring board, rectifier unit, unit 10

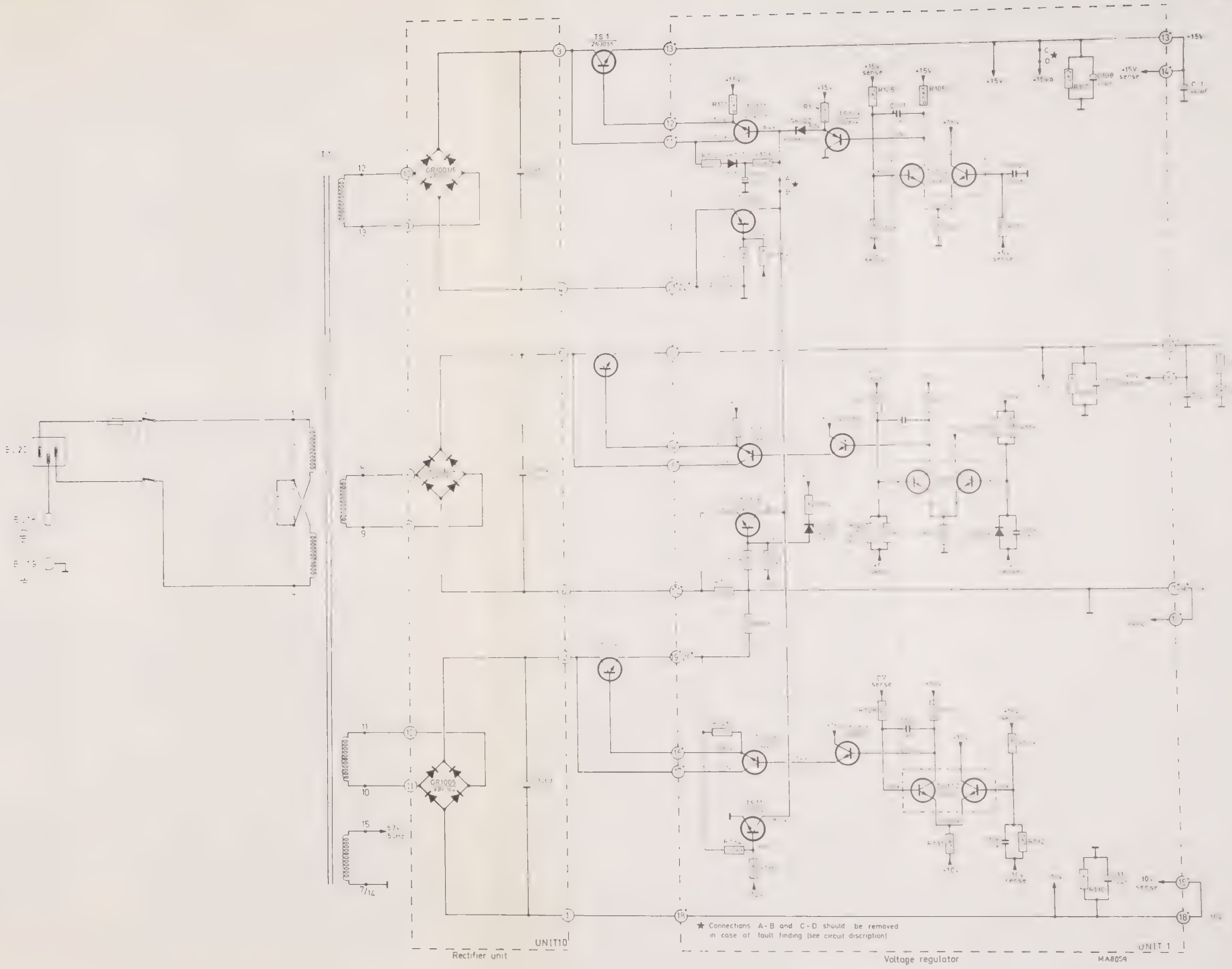


Fig. IX-3. Circuit diagram, Power supply, units 1 + 10

X. Unit 2, pluge generator

This unit contains the circuits which generates the control signals: "f", "g", "h" and "i" for the PLUGE generator in this unit and for the switchable output I generator in unit 4.

The working principle of this unit can be explained with the aid of the pulse diagram Fig. X-2.

A part of the pluge signal is generated in the 4:1 divider (IC5/1-2).
This divider is supplied with clock pulses (18 per active line via terminal 16*).
The divider is controlled by the one-shots IC3 and IC4, which are triggered by the line pulse $\overline{f_H}$*. IC4 determines the period in which the 4:1 divider is operating.

The "i" and "h" signals are supplied directly from the divider to terminals 9* and 10* respectively.
The "g" signal is derived from IC6/3 by combining the "h" and "i" signals.

The "f" signal which represents the white reference bar in the PLUGE signal is generated in one-shot IC1 (34 μs).

This one-shot is also triggered by the line pulse $\overline{f_H}$*.

The PLUGE generators TS4-5, TS6-7 (black-level bars) TS1-2 (white reference bar) and TS8-9 (sync adder) are constant current generators.
The principle of the current generators is explained in the description of the block diagram.
The current and thus also the voltage across the output resistor R21 can be adjusted by means of the respective emitter resistors R18, R11, R15 and R5 (see Checking and Adjusting).
The 250 ns filter corrects the rise- and fall time of this signal.

Checking and adjusting

For adjustments in this unit see section: Common adjustments and pulse level adjustments (see Service Instructions, chapter VIII).

Measuring equipment:
Oscilloscope : e.g. PHILIPS PM 3250
Video level meter: e.g. PHILIPS PM 5548

Positioning of the pluge bars

Connect the A amplifier of the oscilloscope to BU6 "CROSS HATCH".
Connect the B amplifier to terminal 6 of IC3.
The trailing edge of the IC3 pulse should be in the middle of the 3rd and 4th grid bar (see Fig. X-3).
If not select another value for R2 (5.6 kΩ - 12 kΩ).
Connect the B amplifier to terminal 6 of IC4.
The trailing edge of the IC4 pulse should be in the middle of the 6th and 7th grid bar (see Fig. X-3).
If not select another value for R3 (8.2 kΩ - 16 kΩ).

Positioning of the white bar

Connect the A amplifier of the oscilloscope to terminal 11* ($\overline{f_H}$*).
Connect the B amplifier to terminal 14* (IC1 pulse f).
The distance from the leading edge of the f_H* pulse to the trailing edge of the IC1 pulse (f) should be 34.4 μs ± 0.5 μs.
If not select another value for R1 (10 kΩ - 18 kΩ).

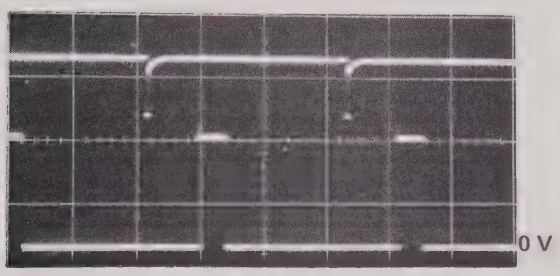
230 ns filter

Connect the oscilloscope to BU7 "PLUGE".
The leading and trailing edges should be 230 ns each (measured between 10-90 %).
If not readjust L1.

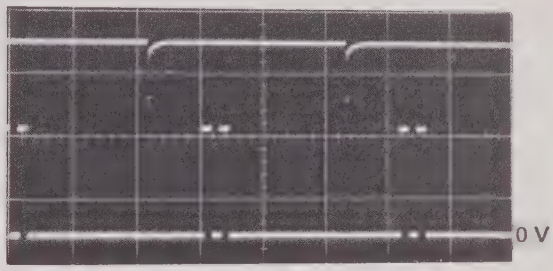
Sync. and PLUGE levels

Connect the Video level meter PM 5548 to BU7 "PLUGE".

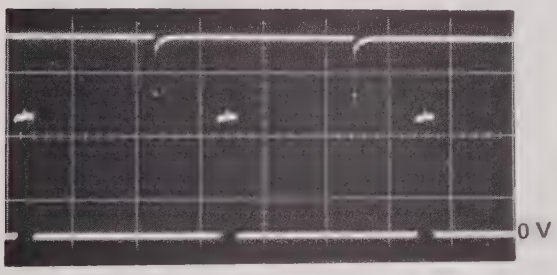
1. Remove sync. by disconnecting jumper (sync-off).
   Remove PLUGE pulses by adjusting R11 and R15.
   Adjust the white reference pulse to 0.700 V by means of R5. (If necessary select R6) (see Fig. X-4).
2. Apply sync. by mounting jumper.
   Adjust sync. to 0.300 V by means of R18. (If necessary select R19).
3. Adjust PLUGE pulses (0 - 35 mV, normal amplitude is 14 mV) by means of R11 and R15 (see Fig. X-5).



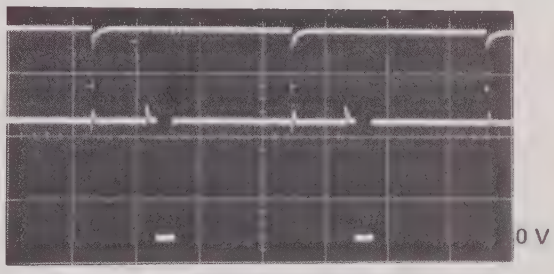
1 2 V/div. 20 µs/div.
reference: $\overline{f_H}$*



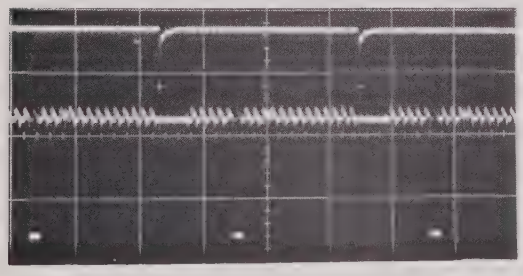
2 2 V/div. 20 µs/div.
reference: $\overline{f_H}$*



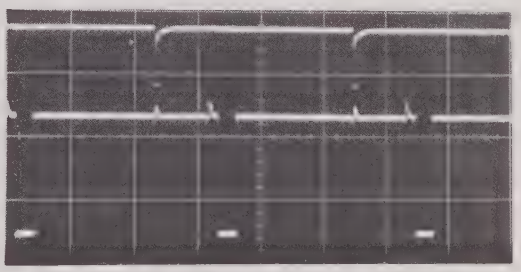
3 2 V/div. 20 µs/div.
reference: $\overline{f_H}$*



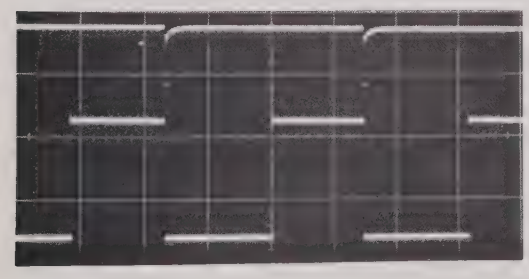
4 2 V/div. 20 µs/div.
reference: $\overline{f_H}$*



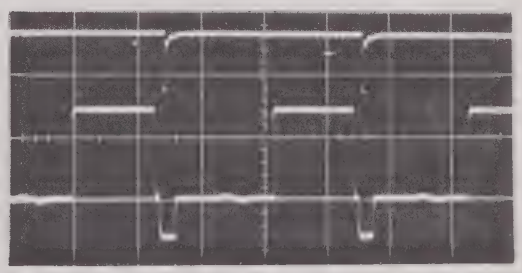
5 2 V/div. 20 µs/div.
reference: $\overline{f_H}$*



6 2 V/div. 20 µs/div.
reference: $\overline{f_H}$*



7 2 V/div. 20 µs/div.
reference: $\overline{f_H}$*



8 1 V/div. 20 µs/div.
reference: $\overline{f_H}$*

Fig. X-1. Oscillograms, unit 2

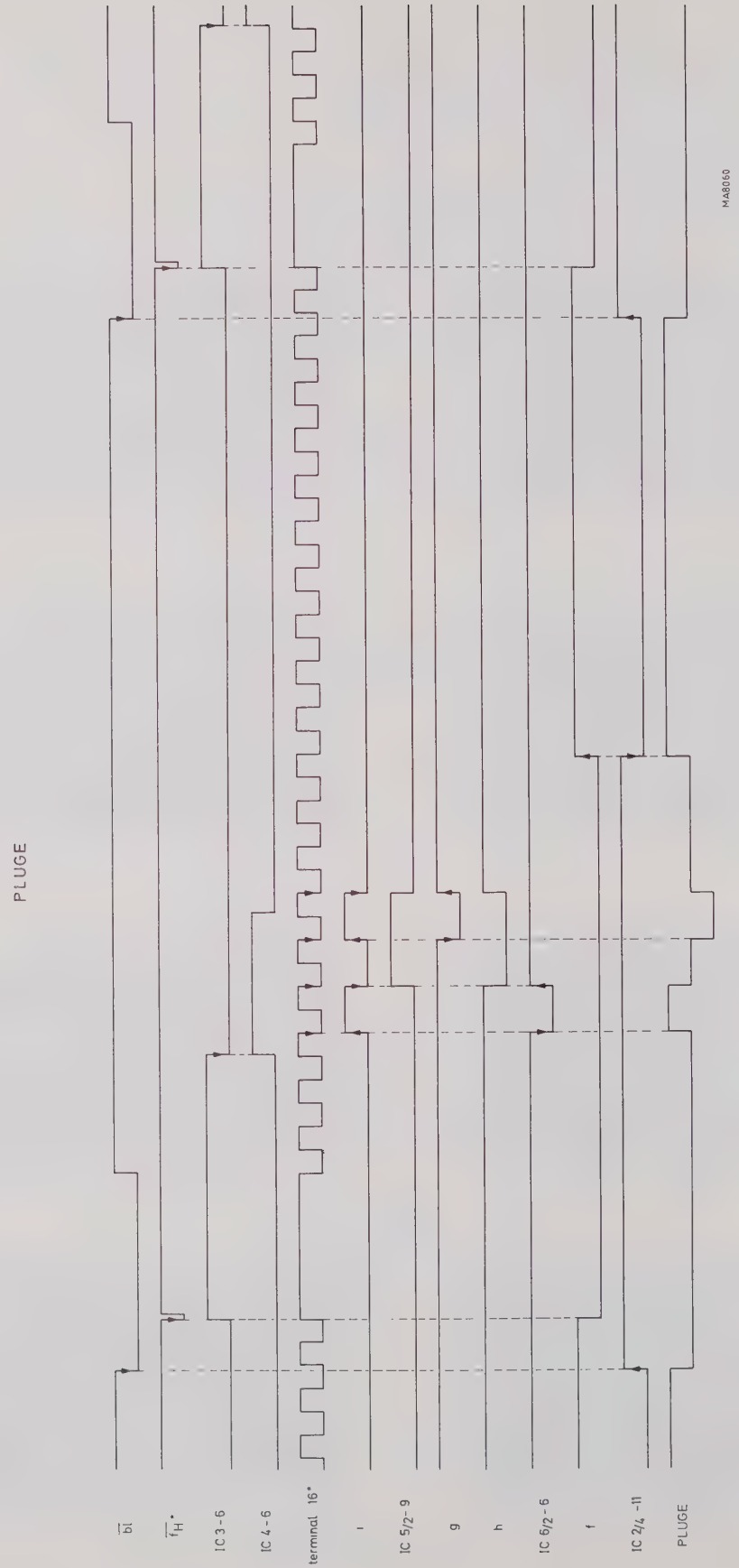


Fig. X-2. Pulse diagram of the pluge signal

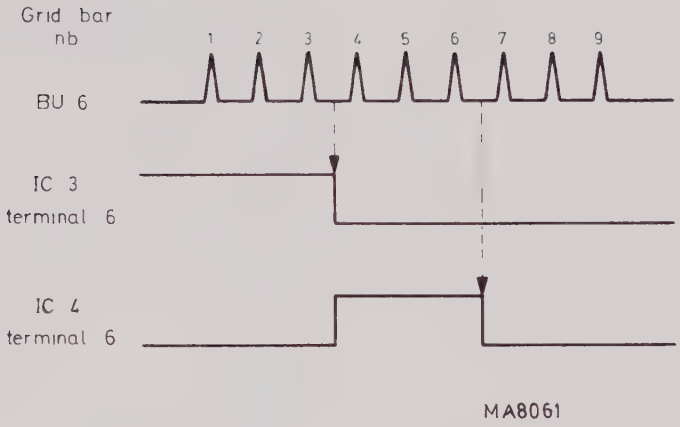


Fig. X-3. Pulse diagram position of the pluge bars

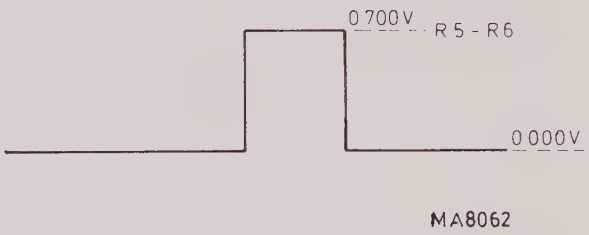


Fig. X-4. Pulse diagram of the white reference signal

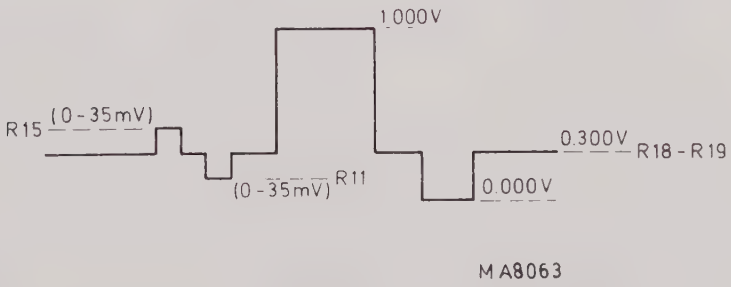


Fig. X-5. Pulse diagram of the pluge levels

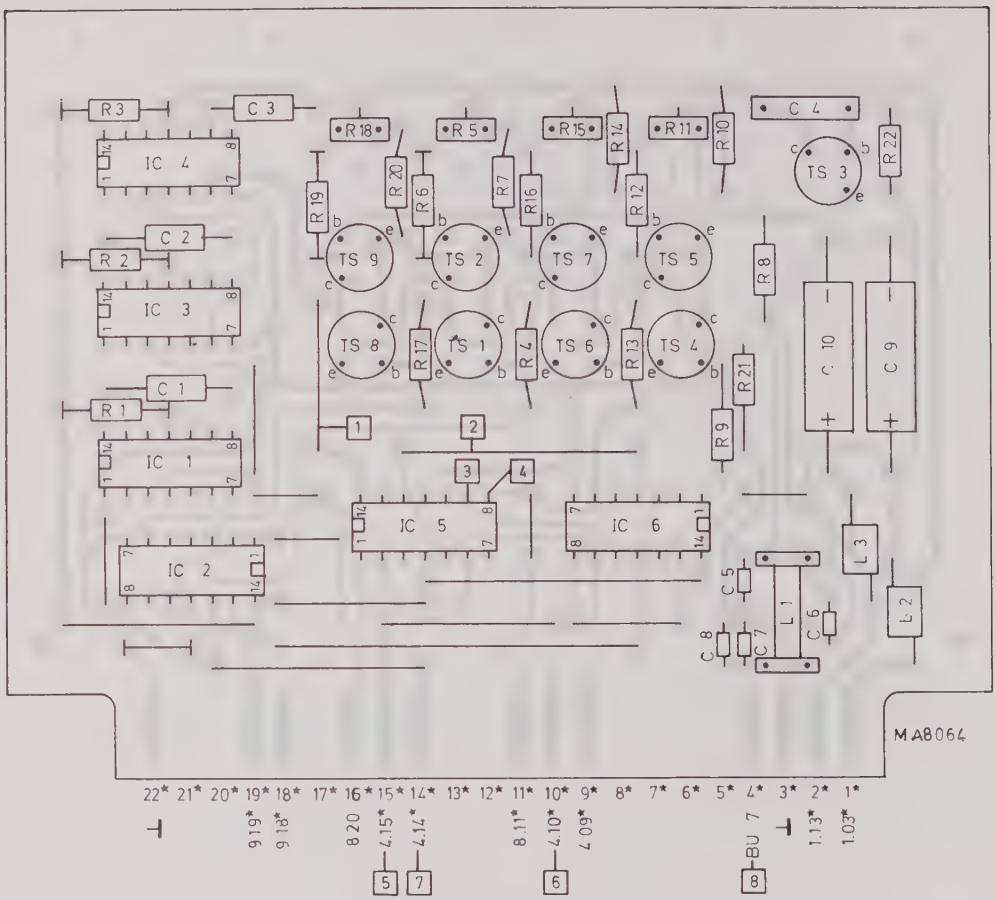


Fig. X-6. Printed wiring board, pluge, unit 2

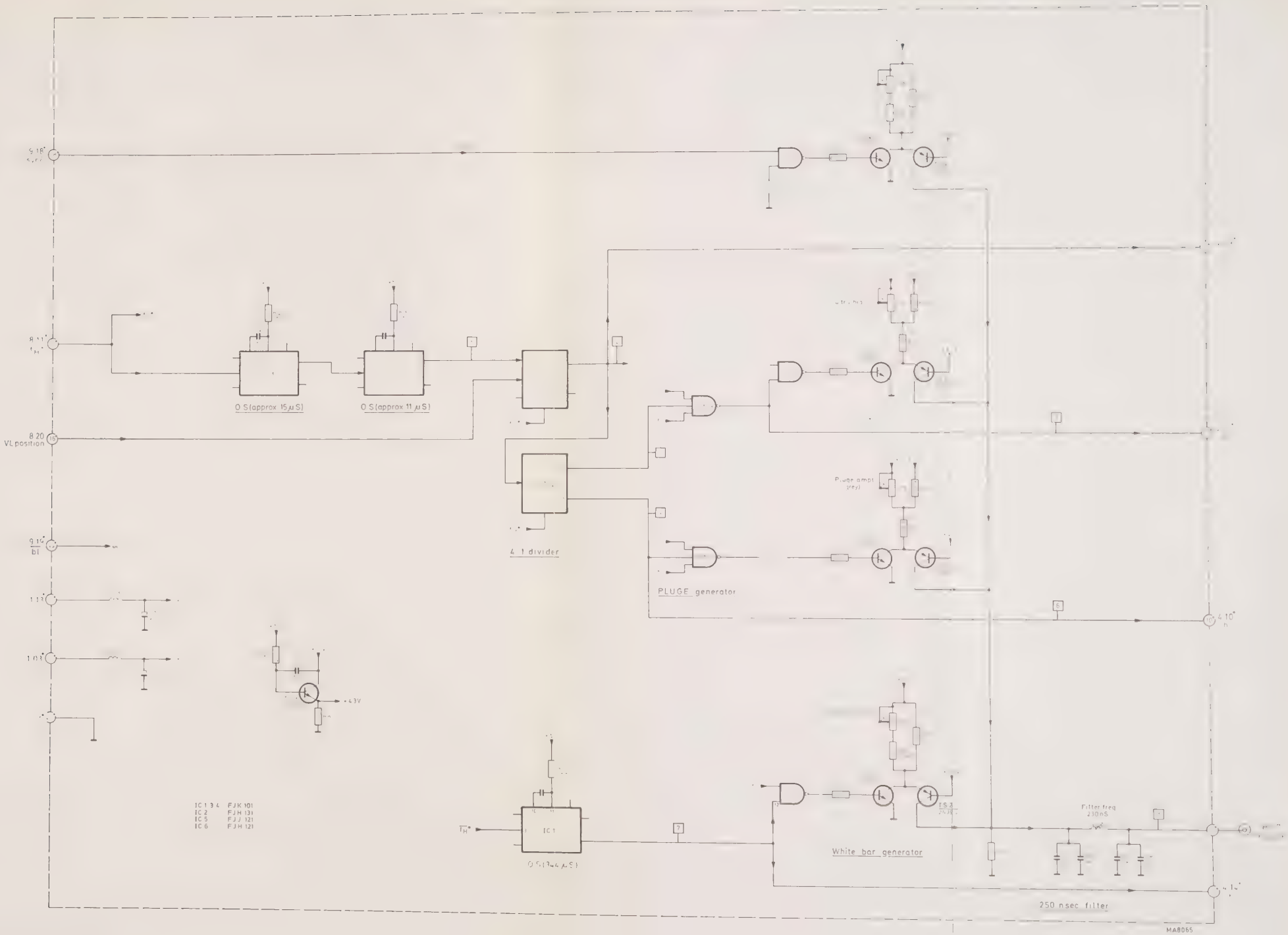


Fig. X-7. Circuit diagram, pluge, unit 2

XI. Unit 3, crosshatch/dots

The cross-hatch dots pattern is obtained from the "Cross hatch/dots generator", supplied with horizontal and vertical information.

The horizontal information is generated by one-shot (260 ns) IC13.
This one-shot is triggered by the applied pulses from the horizontal divider unit 8 (18 pulses per active line - the 18 vertical lines of the pattern).

The vertical information is obtained from the vertical dividers IC7 and IC8 (2 x 4 bits counters).
The clock pulse for the divider is the line sync. pulse $\overline{f_H}$.
The divider is coded as a 21:1 divider (18:1 in the M version) by means of the gate IC9/1.
This means one pulse (one white line) for every 21st line of the line pulses.

The clock pulses f_H are applied to the divider via the gate IC6/1.
This gate is controlled by a signal from the "Vertical delay" system (via SK12 "VERTICAL POSITION") and controls in this way the start of the divider.

The width of the control signal to the gate IC6/1 has to be a multiplication of a line, if not, the vertical divider will supply white lines which could start accidentally during a line.

The "Vertical delay" is therefore constructed as a counter system, counting line pulses.
At the beginning of a new field the dividers are cleared by a pulse generated in IC12 (166 μs).
The output of IC5/1 is low which means that the gate IC1/1 is open and IC6/1 is closed.

The line pulses f_H will now pass on to the "decade counter" IC2.
From the four outputs of IC2 the pulses are applied to the "BCD to decimal decoder" IC3.
The outputs of this decoder are - when cleared - high (1).
At the first line pulse to IC2 the state of terminal 1 will shift to low (0).
At the next line pulse terminal 1 will shift back to high, and terminal 2 will shift to low, and so on (see Fig. XI-2).
The outputs are via SK12 connected to the NOR gate IC5/1.
For the first 10 positions of the switch the other input of the gate is connected to ground.
For the next 5 positions the input is connected to IC4, which will first shift to low at line pulse no. 11.

If switch SK12 f. inst. is set in pos. 12 both inputs of IC5/1 will become low after 12 line pulses.
The state of the output will then shift to high, which means that IC1/1 is closed while IC6/1 is open, and the "Vertical divider" starts counting.
The "Cross hatch dots generator" is either a cross hatch or a dots generator.
When the jumper is connecting IC10/1 to ground the generator supplies cross hatch.
When the jumper is connecting IC10/2 and IC11/1 to ground the generator supplies dots.
The output amplifiers for crosshatch-dots and sync. TS1, TS2, TS4 and TS5 are constant current generators.
The principle of constant current generators is explained in the description of the block diagram.

The current and thus also the voltage across the output resistor R12 can be adjusted by means of the respective emitter resistors R4 and R9 (see Checking and Adjusting).
The 100 ns filter is correcting the rise- and fall time of the signal.
The white reference bar is generated in the one-shot IC11/4-TS11 (see Fig. XI-3).
The one-shot is triggered by the line pulse $\overline{f_H}$* which shifts the output state to high.
Input 12 of IC11/4 will then be low and thus keep the output high for a certain time which is controlled by the RC time of C8-R25.
In the following gate (IC14/3) the width of the pulse is limited by the blanking pulse.

The output amplifiers for the sync. and reference bar are similair to those of the crosshatch-dot generator.

Checking and adjusting

Measuring equipment:

Oscilloscope : e.g. PHILIPS PM 3250
Video level meter: e.g. PHILIPS PM 5548

For adjustments in this unit see section: Common adjustments and pulse level adjustments (see Service Instruction, chapter VIII).

Width of the white ref. bar

Connect the oscilloscope to BU8 "WHITE REFERENCE".
The width of the reference bar should be 10 μs ± 0.1 μs.
If not select another value for R25.

100 ns filters

Connect the oscilloscope to BU6 "CROSS HATCH" resp. BU8 "WHITE REFERENCE".
The leading and trailing edges should be 100 ns (measured between 10-90 %).
If not readjust L1 resp. L2.

Amplitude, Crosshatch/Dots

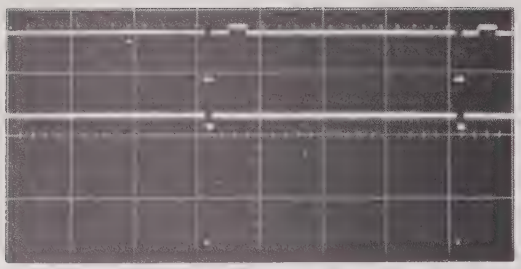
Connect the Video level meter PM 5548 to BU6 "CROSS HATCH".

1. Remove sync. by disconnecting jumper at "sync. off".
   Mount jumper for crosshatch or dots - respectively C or D.
   Adjust crosshatch/dots amplitude to 0.700 V by means of R4.
   If necessary select R5 (See Fig. XI-4).
2. Apply sync. by removing jumper "sync. off".
   Adjust sync. level to 0.300 V by means of R9. If necessary select R10 (See Fig. XI-5).

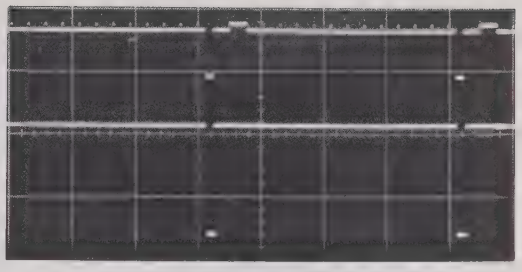
Amplitude, White reference

Connect the Video level meter PM 5548 to BU8 "WHITE REFERENCE".

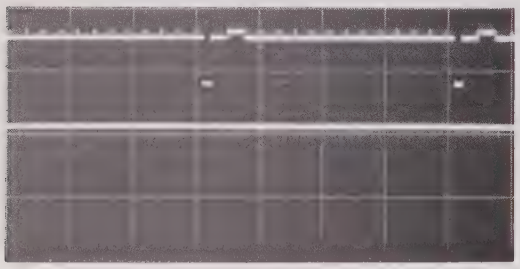
1. Remove sync. by disconnecting jumper at "sync. off".
   Adjust white reference to 0.700 V by means of R19. If necessary select R18 (See Fig. XI-6).
2. Apply sync. by removing jumper at "sync. off".
   Adjust sync. level to 0.300 V by means of R15. If necessary select R14 (See Fig. XI-7).



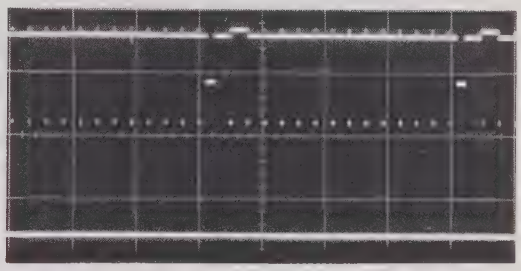
9 2 V/div. 5 ms/div.
reference: $\overline{f_{V*}}$



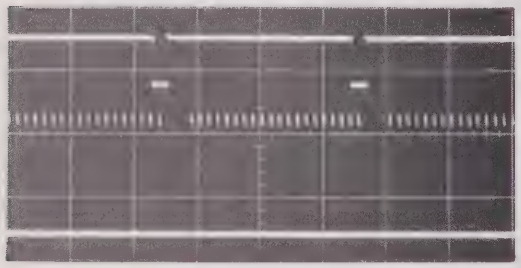
10 2 V/div. 5 ms/div.
reference: $\overline{f_{V*}}$



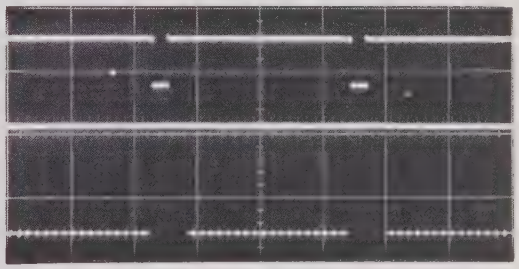
11 2 V/div. 5 ms/div.
reference: $\overline{f_{V*}}$



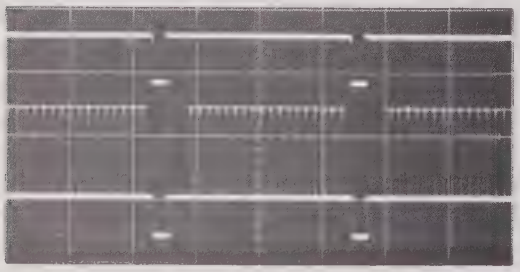
12 2 V/div. 5 ms/div.
reference: $\overline{f_{V*}}$



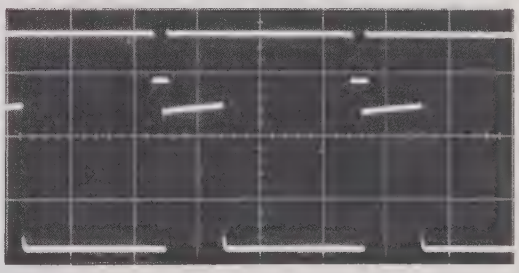
13 2 V/div. 20 µs/div.
reference: $\overline{f_H}$



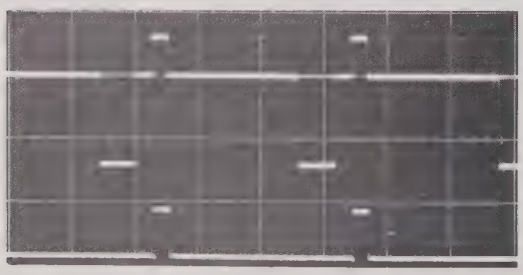
14 2 V/div. 20 µs/div.
reference: $\overline{f_H}$



15 0.5 V/div. 20 µs/div.
reference: $\overline{f_H}$ BU6 terminated with 75 Ω



16 2 V/div. 20 µs/div.
reference: $\overline{f_H}$



17 0.5 V/div. 20 µs/div.
reference: $\overline{f_H}$ BU8 terminated with 75 Ω

Fig. XI-1. Oscillograms, unit 3

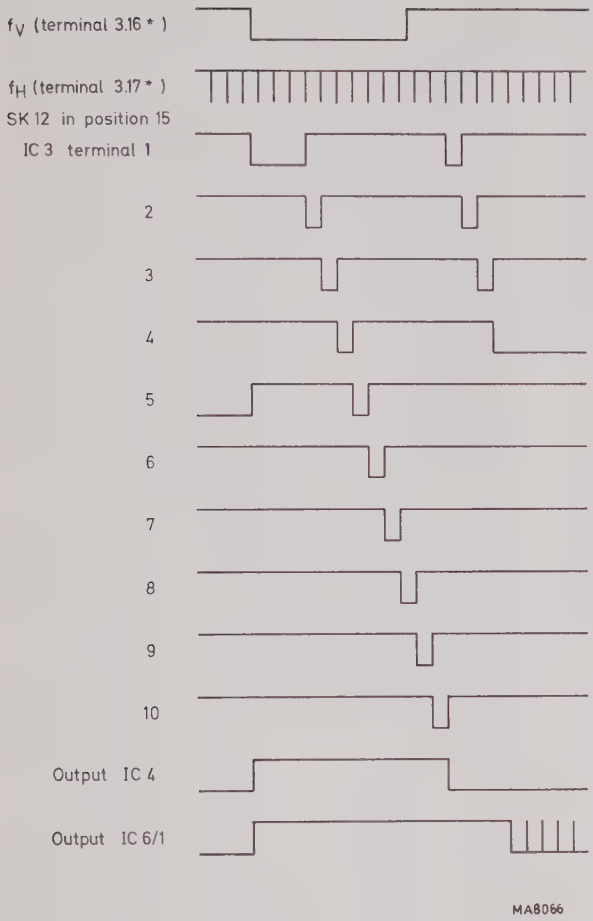


Fig. XI-2. Pulse diagram of "BCD to decimal decoder" IC3

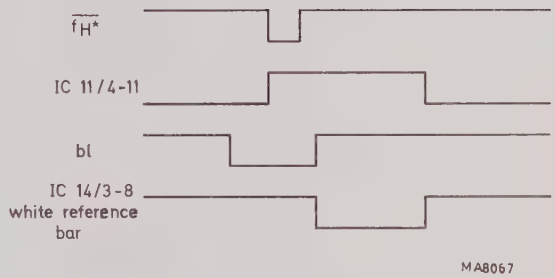


Fig. XI-3. Pulse diagram of the white reference bar

Fig. XI-4. Pulse diagram, amplitude of the cross hatch/dots

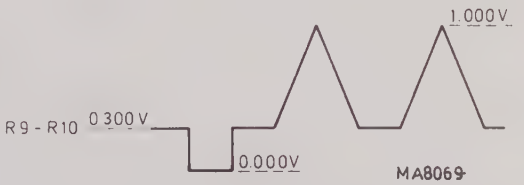


Fig. XI-5. Pulse diagram, amplitude sync. level cross hatch/dots

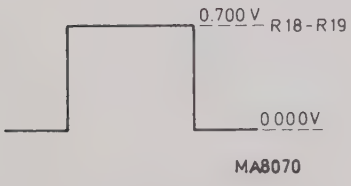


Fig. XI-6. Pulse diagram, amplitude of the white reference signal

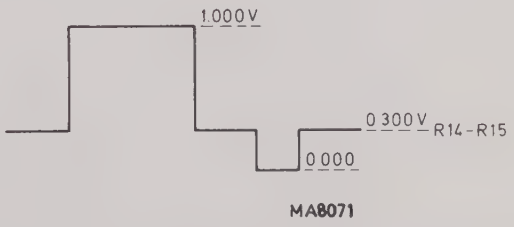


Fig. XI-7. Pulse diagram, amplitude of the sync. level/white reference

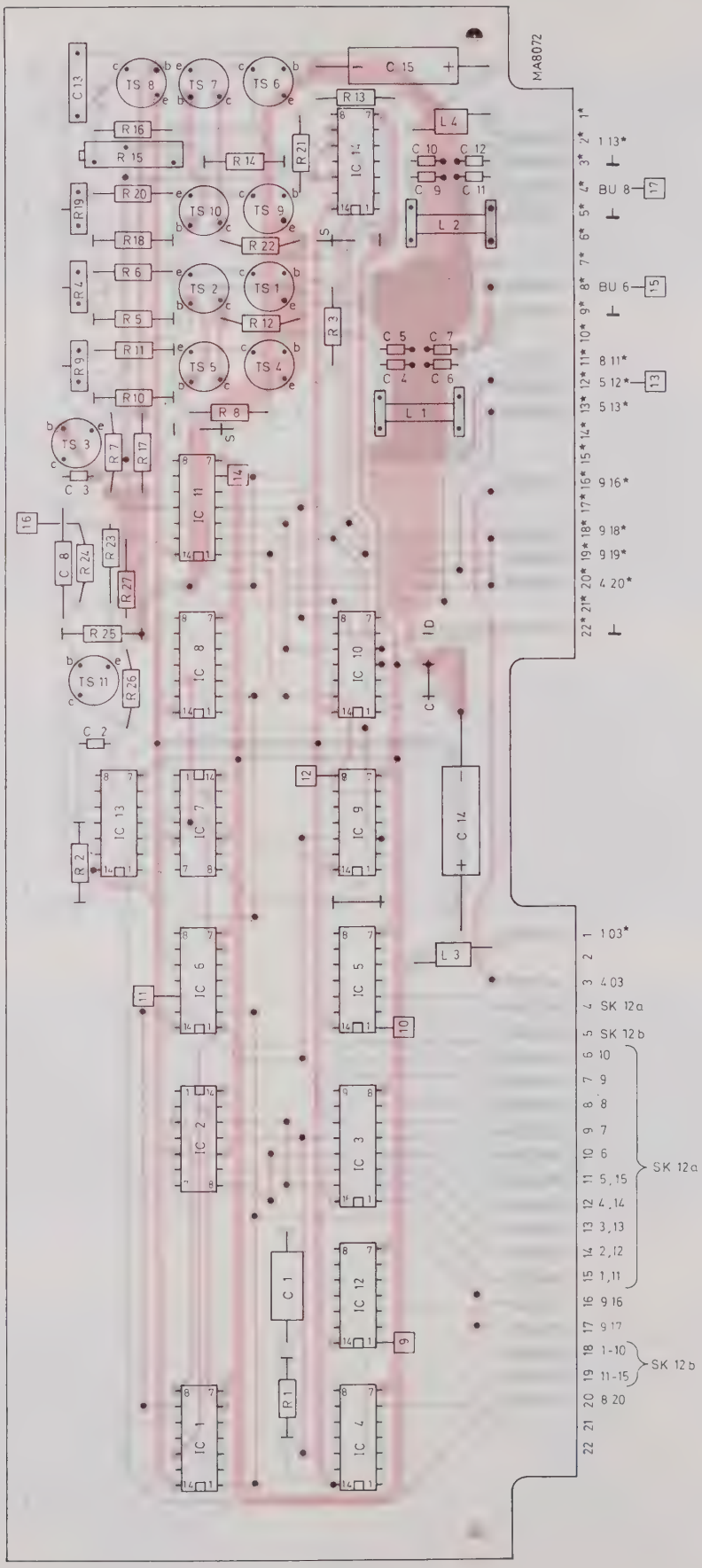


Fig. XI-8. Printed wiring board, cross hatch/dots, unit 3

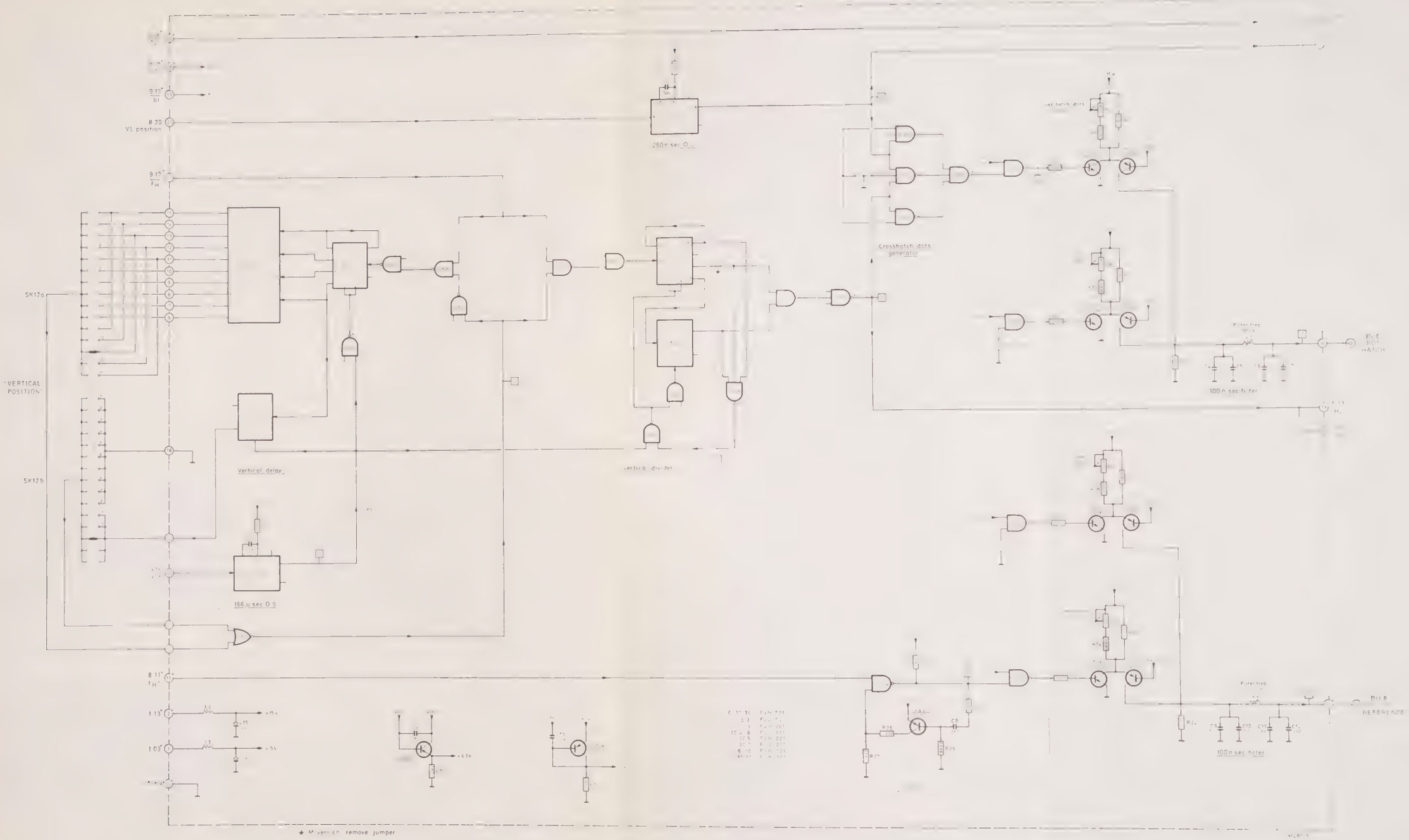


Fig. XI-9. Circuit diagram, cross hatch/dots, unit 3

XII. Unit 4, switchable output I

This unit contains the generators for the "PLUGE", the "WHITE", the "RED" and the "COLOURBAR" signals.

The PLUGE generator is similar to that in unit 2 (see also Fig. X-2, chapter X).
In IC3/2 the "h" and "i" signals are added to the ultra black part of the black level PLUGE.
In IC2/3 the grey part of the PLUGE is gated by means of the "g" signal.
In IC2/2 the white reference bar is gated by means of the "f" signal.
The three above mentioned gates are via IC1/2 controlled by the switches:
SK7 "PLUGE NORMAL" and SK8 "PLUGE BLACK".
When SK8 is pressed gate IC1/1 is closed and the white reference bar is removed from the PLUGE signal.

The three pulses of the PLUGE signal control the respective current generators.
These three current generators are similar to those in unit 2, in order to supply the signal as R, G, B signals.

The current generators TS2, TS3 and TS4 also supply the "WHITE" and the "RED" signals.

When SK9 "WHITE" is pressed the output of IC3/1 is high.
Due to this the output of IC1/1 is low in the active line period (the blanking signal $\overline{b1}$ is also applied to this gate).
Transistor TS1 is therefore non-conducting which means that the current amplifiers TS2, TS3 and TS4 supply an equal current on the R,G, B lines, leading to a "white" signal.

When SK10 "RED" is pressed the same process as described above will take place, but at the same time IC2/1 will drive TS5 into saturation which will interrupt the current amplifiers TS3 (green) and TS4 (blue). This means that only TS2 (red) will supply a signal (leading to a "red" signal).

The colour bar generator can supply the colourbars described in Fig. XII-2;
The upper part of the pulse diagram shows the R, G, B signals as they are supplied from the generator, and the lower part how the signals appear after encoding.

Additionally the generator can supply the colour bar signal with a horizontal white bar in the top of the picture.

The standard colourbar is generated in the current generators TS18/TS19, TS20/TS21 and TS22/TS23 which are in turn controlled by the R, G, B and blanking signals via the gates IC5/3, IC5/2 and IC4/2 respectively.
The R, G, and B signals are generated in unit 8.

The current generator which in principle is explained in the description of the block diagram can be adjusted to supply a 100 % or a 75 % colourbar by soldering tags (see modification chapter VII).

The 25 % adder, when activated, supplies 25 % extra current to the R, G, B lines.
The adder can only be activated when the colourbar is adjusted to 75 %.

The adder can either be controlled by the BBC gate or the EBU gate (changed by soldering, see modification chapter VII).

The BBC gate IC7/3 (see Fig. XII-3) is controlled by the blanking pulse and the "e" pulse which is generated in unit 8.
The output of the gate will keep TS14 non-conducting during the colourbar (inclusive the white bar) which will activate the "25 % adder".

The EBU gate IC8 (see fig. XII-3) is controlled by the R, G, B and blanking pulses.
The output of the gate will keep TS14 non-conducting during the white bar of the colourbar signal, which in turn will activate the "25 % adder".

The horizontal white bar is generated in IC7/1 by adding the pulses from the 4:1 divider IC6 (see fig. XII-4).
The divider is clocked by the horizontal white line pulses H_L, which appears for every 21st line (M system: 18th line) of the line pulses.
This result in a horizontal bar (~ 42 lines) which will activates the three current generators for the R G B signals via gate IC7/2.

Checking and adjusting

Measuring equipment:

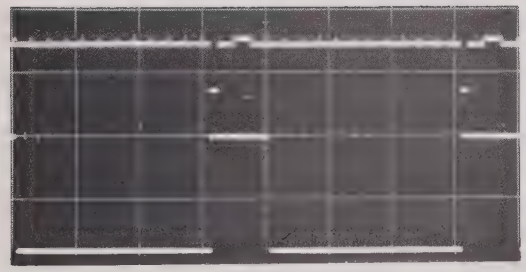
Oscilloscope : e.g. PHILIPS PM 3250
Video level meter: e.g. PHILIPS PM 5548

For adjustments in this unit see section: Common adjustments and pulse level adjustments (See Service Instructions chapter VIII).

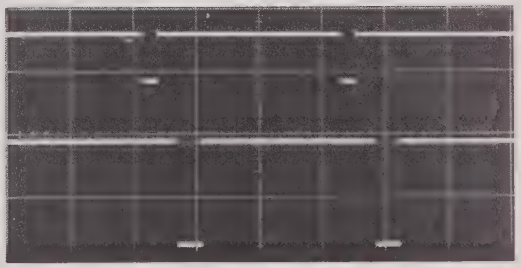
Amplitude

Connect the Video level meter PM 5548 to the "SWITCHED OUTPUT" (BU13 "R", BU14 "G" and BU15 "B" respectively).

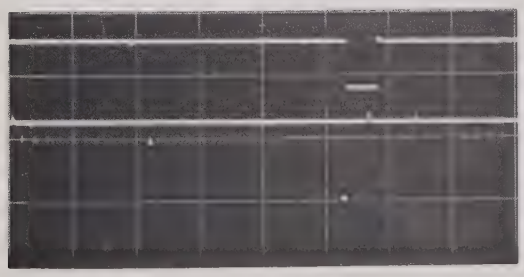
1. The PLUGE generator adjustments are the same as for unit 2 with the exception of those pertaining to sync.
   Adjust the white bar of the R-G-B-outputs by means of R3-R6-R9 respectively.
   Adjust the PLUGE pulses by means of R18-R21-R24 and R29-R32-R35.
2. The colourbar generator adjustments are the same as for unit 7.
   Adjust the R-G-B signals by means of R51-R58-R65 and the white bar by means of R38-R41-R44.



18 2 V/div. reference: $\overline{f_V}$ 5 ms/div.



19 2 V/div. reference: $\overline{f_H}$ SK3 "Colour bar" pressed 20 µs/div.



20 2 V/div. reference: $\overline{f_H}$ SK3 "Colour Bar" pressed 10 µs/div.

Fig. XII-1. Oscillograms, unit 4

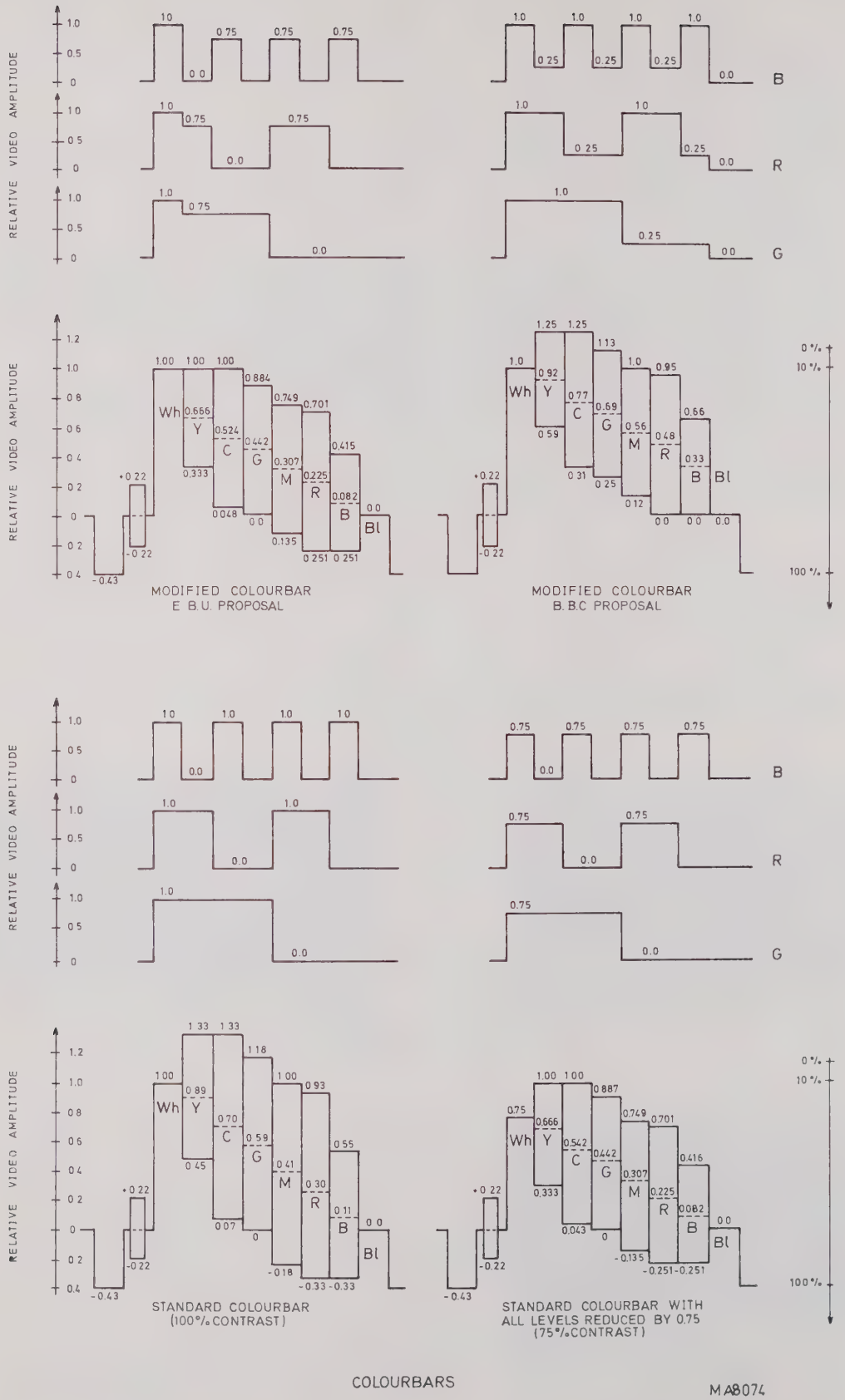


Fig. XII-2. Pulse diagram of the colour bar

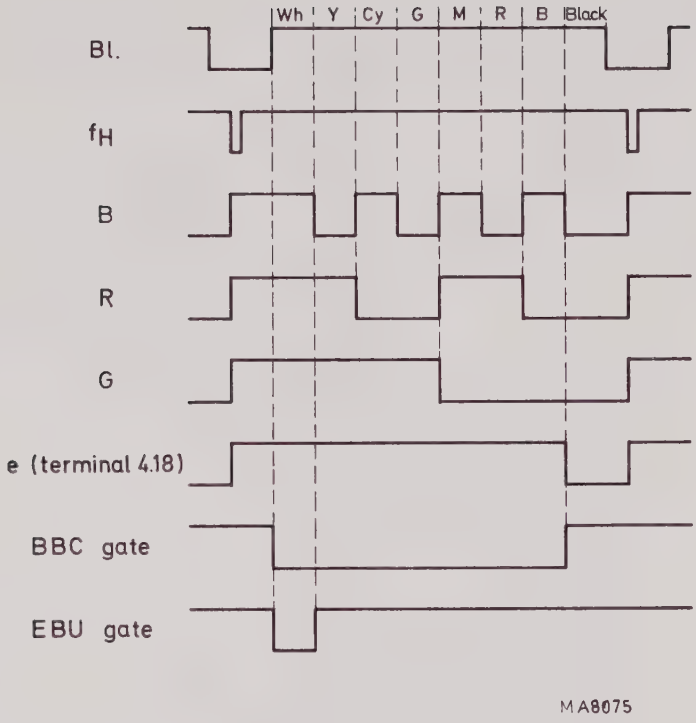


Fig. XII-3. Pulse diagram of the BBC and EBU gates

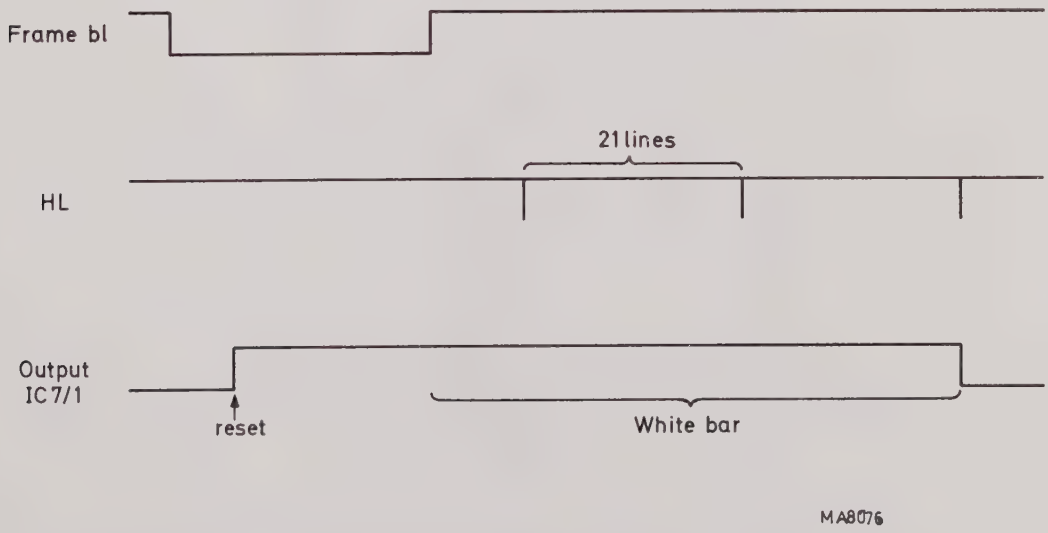


Fig. XII-4. Pulse diagram of the horizontal white bar signal

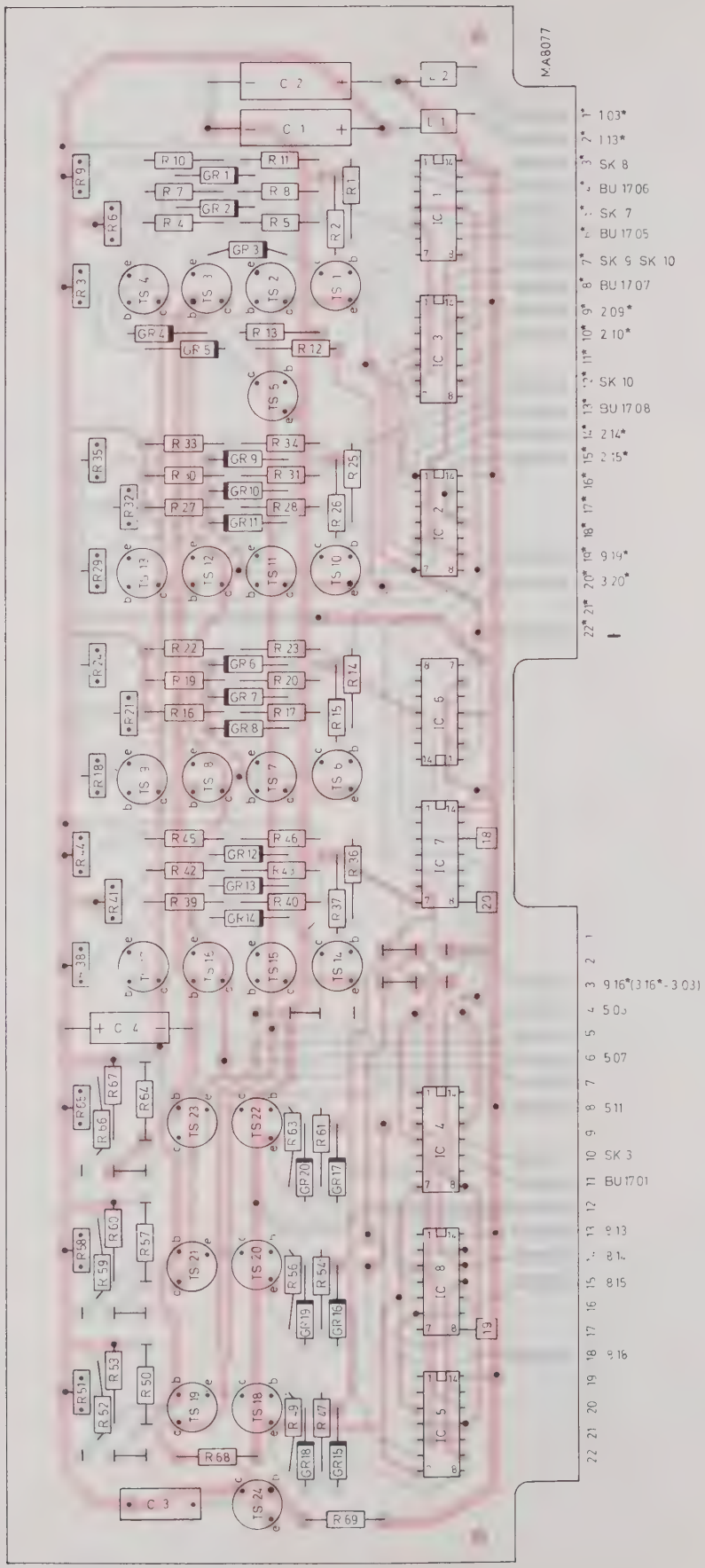


Fig. XII-5. Printed wiring board, switchable output I, unit 4

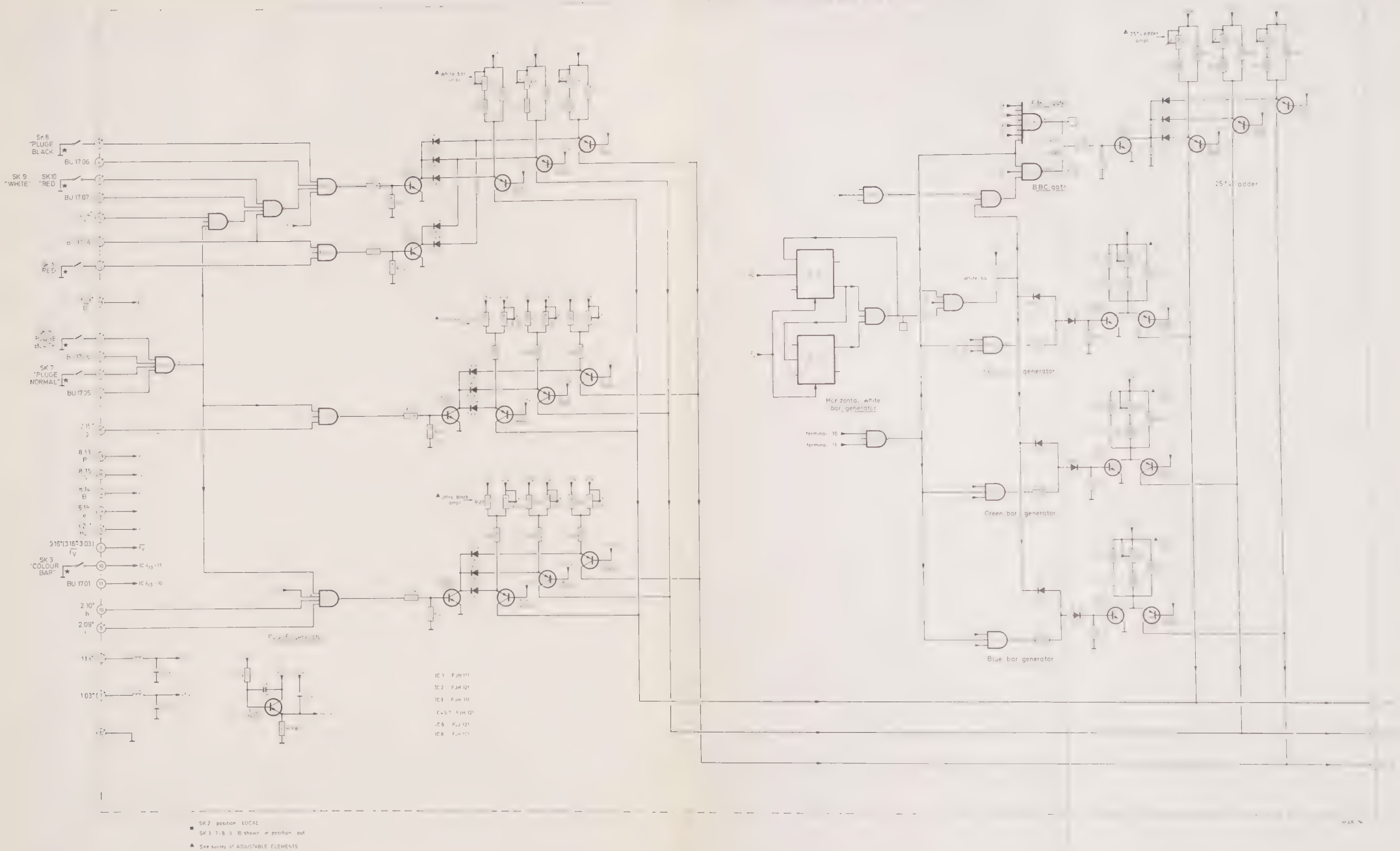


Fig. XII-6. Circuit diagram, switchable output I, unit 4

XIII. Unit 5, switchable output II

This unit contains the generators for the "GREYSCALE", the (B-Y) (R-Y) and the CROSS HATCH/DOTS signals.
It also contains a common output circuit for signals produced in unit 4 and in this unit.

The "Greyscale generator" is controlled by the pulses a, b, c and d generated in unit 8 (Fig. XIII-2).
These pulses are applied to the output amplifiers via the gates IC6 and IC7, where the blanking signal is added.
The output amplifiers, which are current generators, are in triple in order to supply the R G B signals.
The function of the current amplifier is explained in the description of the block diagram (chapter IV).
The four sets of output amplifiers are adjusted so that the first one (TS13-TS16) supplies a current according to an output voltage of 1/10 of the total voltage across R76-R78.
The current of the next one (TS17-TS20) will develope a voltage of 2/10 of the total voltage.
The third one (TS21-TS24) will develope 4/10 and the fourth one (TS25-TS28) 8/10 of the total voltage.
In Fig. XIII-2 is show how the pulses a , b, c and d are added to obtain an 11 levels or a 6 levels greyscale.
By means of internal soldering the 6 or the 11 levels greyscale can be selected.

At delivery the greyscale is adjusted to 11 levels.
The "B-Y/R-Y generator" is controlled by the G and $\overline{G}$ pulses generated in unit 8 (Fig. XVI-2 - chapter XVI).
The pulses are applied to the output amplifier via the gates IC4 and IC5, where the blanking signal is added.
The generators TS5-TS6 and TS11-TS12 supply the B-Y information, and the generators TS7-TS8 and TS9-TS10 supply the R-Y information.
The currents of the generators are adjusted to satisfy the demand for the output voltages:

B-Y : R = 0,1099 V_{pp} B = 0,700 V_{pp}
R-Y : R = 0,700 V_{pp} B = 0,2359 V_{pp}

The "Cross hatch dots generator" IC1-IC3 is supplied with the horizontal lines H_L (one line for every 21st line), and the vertical lines V_L (19 pulses per active line).

When SK5 "CROSS HATCH" is pressed the IC1-3 will function as an OR gate so adding the horizontal and vertical lines to form the cross hatch pattern.
When SK6 "DOTS" is pressed the function of IC1-5 is like an AND gate which only allows the cross points to pass, and thus supplying a dot pattern.

The output amplifiers are similar to the above mentioned current amplifiers.
The output circuit of this unit and the output circuit of unit 4 have in common the 75 Ω output resistors R76, R77 and R78 followed by the 100 ns filters.
The filters are used to correct the rise- and fall time of the signal.

Checking and adjusting

Measuring equipment:
Oscilloscope : e.g. PHILIPS PM 3250
Video level meter: e.g. PHILIPS PM 5548

For adjustments in this unit see section: Common adjustments and pulse level adjustments (see Service Instruction chapter VIII).

100 ns filters

Connect the oscilloscope to BU13 - BU14 and BU15 respectively.
The leading and trailing edges should be 100 ns (measured between 10-90 %).
If not readjust L3, L4 and L5 respectively.

Amplitude

Connect the Video level meter PM 5548 to the "SWITCHED OUTPUT" (BU13 "R", BU14 "G" and BU15 "B" respectively).
The Greyscale generator adjustments are the same as for unit 6 with the exception of those pertaining to sync.

11 levels staircase

Adjust the 2nd level of the R-G-B signals with the potentiometers R34-R37-R40 respectively.
The 3rd level with R45-R48-R51.
The 5th level with R56-R59-R62.
The 9th level with R67-R70-R73.

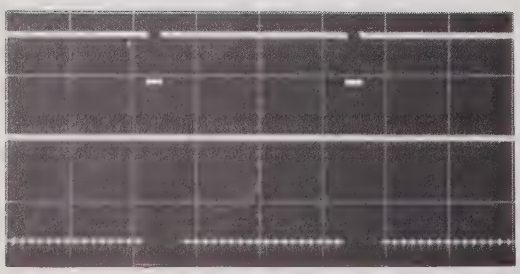
6 levels staircase

Adjust the 2nd level of the R-G-B signals with the potentiometers R45-R48-R51 respectively.
The 3rd level with R56-R59-R62.
The 5th level with R67-R70-R73.

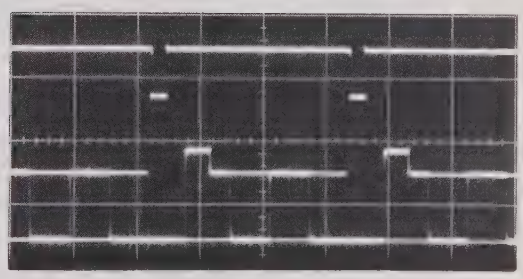
The Cross hatch/dots generator adjustments are the same as for unit 3 with the exception of those pertaining to sync.
Adjust the amplitudes of the R-G-B signals with the potentiometers R3-R6-R9 respectively.

R-Y/B-Y generator

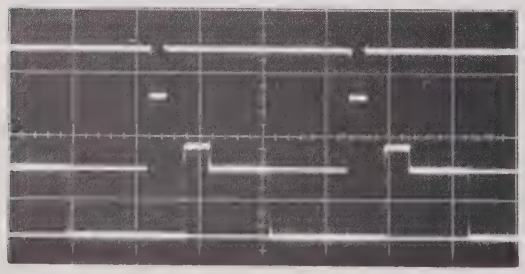
Adjust the 1st level of the R-Y signals to 0.1099 V with R19 and the 2nd level to 0.700 V with R14 (Fig. XIII-3).
Adjust the 1st level of the B-Y signal to 0.700 V with R24 and the 2nd level to 0.2359 V with R29 (Fig. XIII-4).



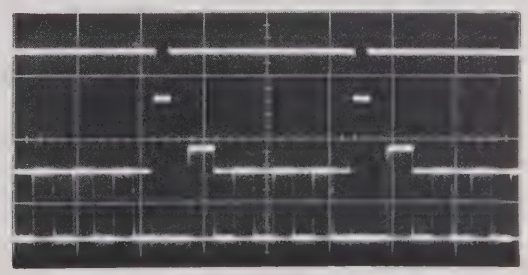
21 2 V/div. 20 μs/div.
reference: $\overline{f_H}$ SK5 "Cross Hatch" pressed



22 1 V/div. 20 μs/div.
reference: $\overline{f_H}$ SK3 "Colour Bar" pressed



23 1 V/div. 20 μs/div.
reference: $\overline{f_H}$ SK3 "Colour Bar" pressed



24 1 V/div. 20 μs/div.
reference: $\overline{f_H}$ SK3 "Colour Bar" pressed

Fig. XIII-1. Oscillograms, unit 5

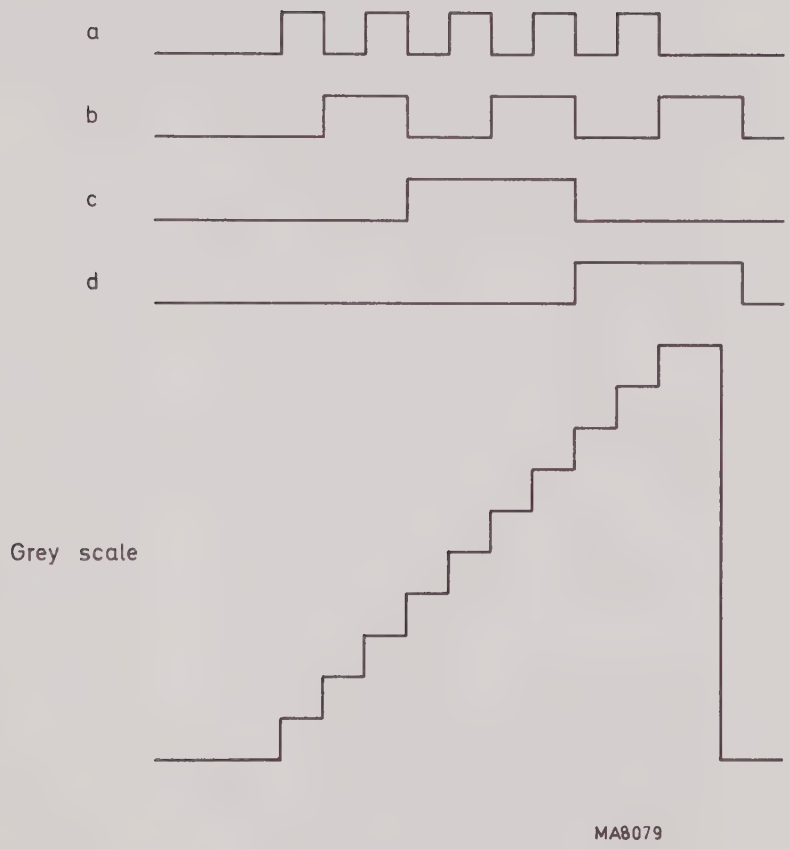


Fig. XIII-2. Pulse diagram of the grey scale signal

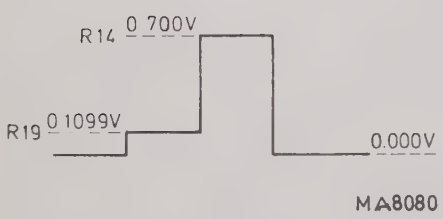


Fig. XIII-3. Pulse diagram of the R-Y level

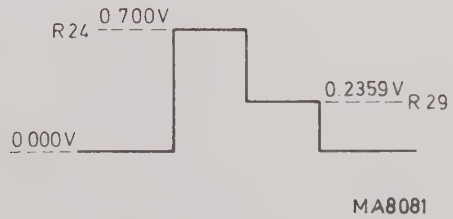


Fig. XIII-4. Pulse diagram of the B-Y level

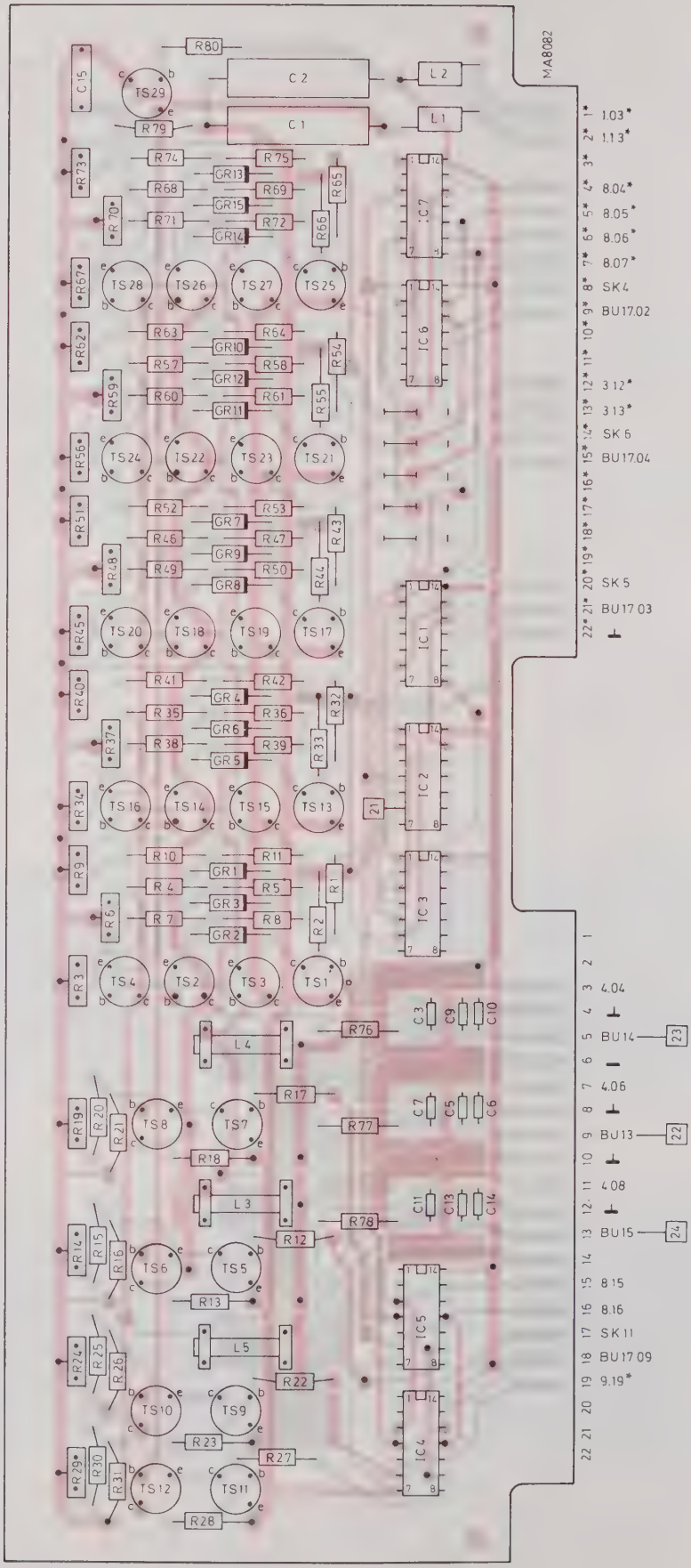


Fig. XIII-5. Printed wiring board, switchable output II, unit 5

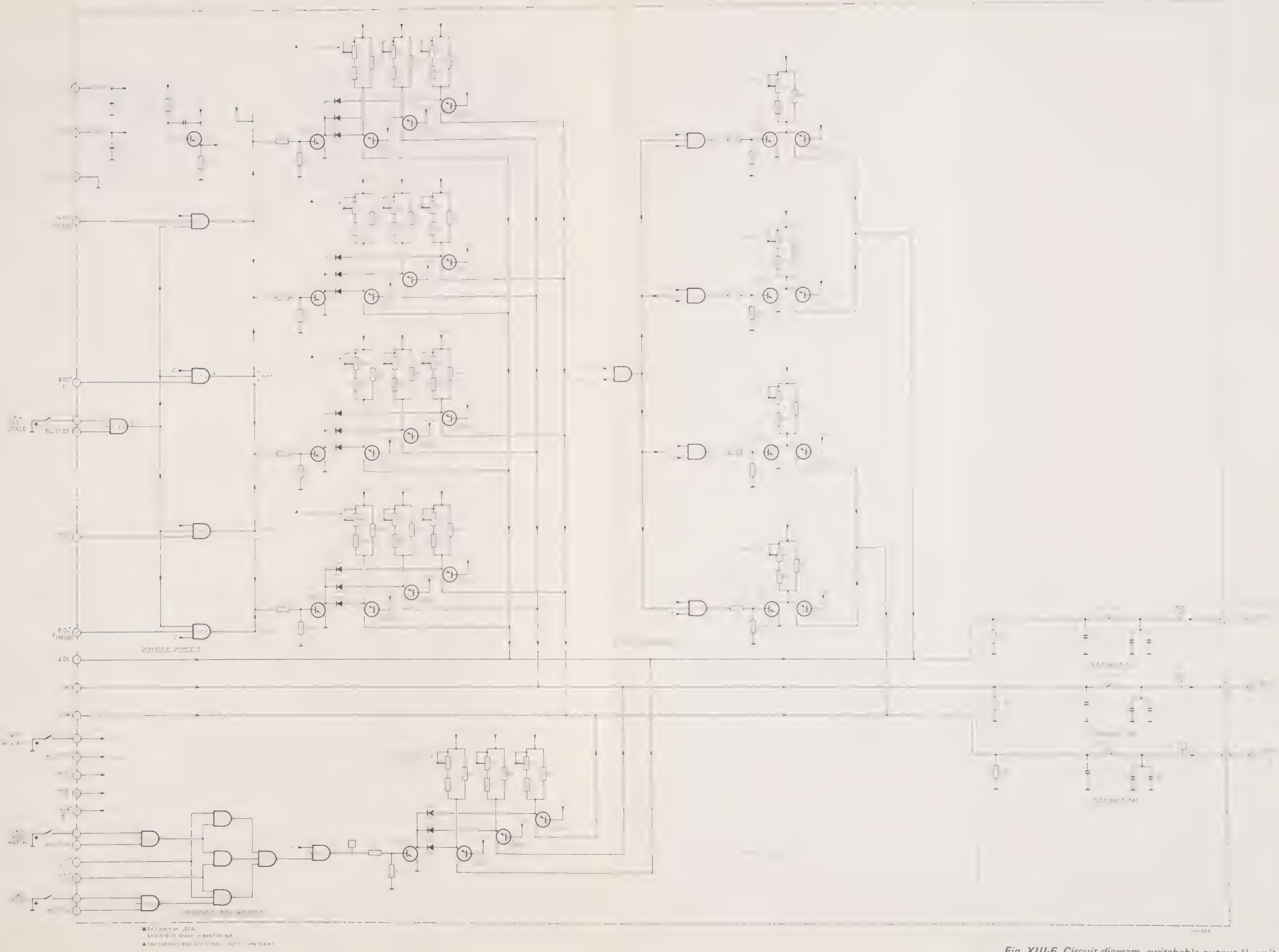


Fig. XIII-6. Circuit diagram, switchable output U, unit 5

XIV. Unit 6, grey scale

The greyscale generator in this unit is similar as the one in unit 5.
The output signal of this generator is supplied as a black and white signal to the output terminal BU5 "GREYSCALE".

The "250 ns filter" is used to correct the rise- and fall time of the signal.
The circuit TS9-TS11 supplies the output signal with sync. (the sync. can be removed by internal soldering, see "Modifications" chapter VII).

Checking and adjusting

Measuring equipment:

Oscilloscope : e.g. PHILIPS PM 3250
Video level meter: e.g. PHILIPS PM 5548

For adjustments in this unit see section: Common adjustments and pulse level adjustments (see Service Instruction, chapter VIII).

230 ns filter

Connect the oscilloscope to BU5 "GREYSCALE".
The leading and trailing edges should each be 230 ns.
If not readjust L3.

Levels

Connect the Video level meter PM 5548 to BU5 "GREYSCALE".

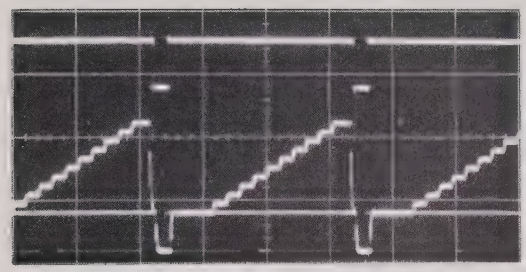
1. **11 levels staircase**

   Remove sync. by mounting jumper at "sync. off".
   Mount jumpers for 11 levels staircase (also in unit 8).
   Adjust 2nd level to 0.070 V with R3.
   Adjust 3rd level to 0.140 V with R8.
   Adjust 5th level to 0.280 V with R13.
   Adjust 9th level to 0.560 V with R18.
   (If necessary select R31).
   The 11th level should now be 0.700 V (Fig. XIV-2).

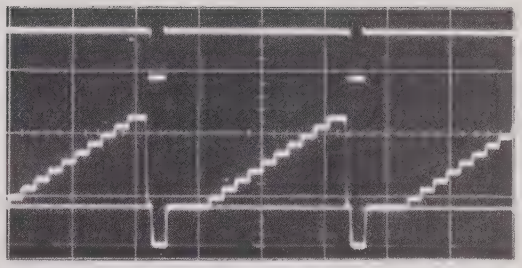
   6 levels staircase

   Remove sync. by mounting jumper at "sync. off".
   Mount jumpers for 6 levels staircase (also in unit 8).
   Adjust 2nd level to 0.140 V with R8.
   Adjust 3rd level to 0.280 V with R13.
   Adjust 5th level to 0.560 V with R18.
   (If necessary select R31).
   The 6th level should be 0.700 V (Fig. XIV-3).

2. Apply sync. by mounting jumper at "sync. on".
   Adjust sync. to 0.300 V with R25 (Fig. XIV-4).



25 1 V/div. reference: $\overline{f_H}$ 20 µs/div.



26 1 V/div. reference: $\overline{f_H}$ 20 µs/div.

Fig. XIV-1. Oscillograms, unit 6

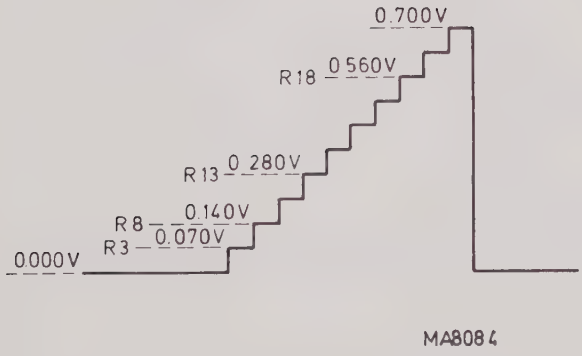


Fig. XIV-2. Pulse diagram of the 11 level staircase signal

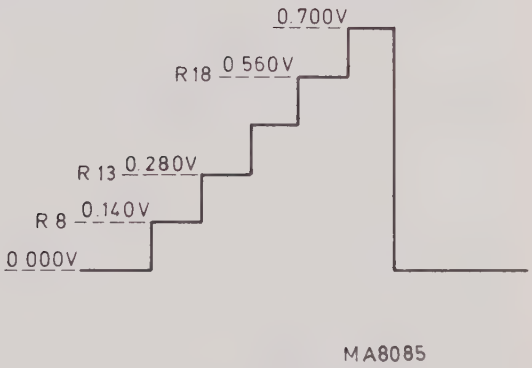


Fig. XIV-3. Pulse diagram of the 6 level staircase signal

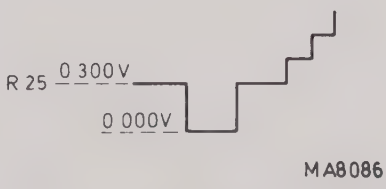


Fig. XIV-4. Pulse diagram of the sync. level in staircase signal

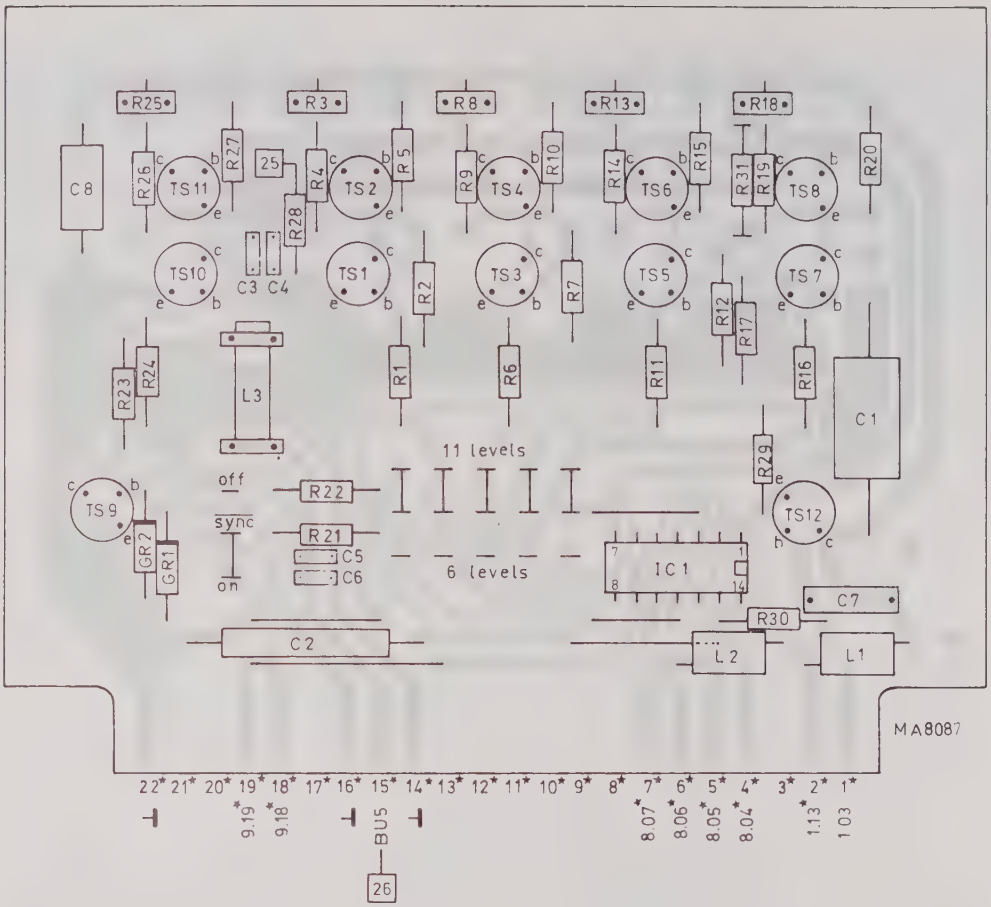


Fig. XIV-5. Printed wiring board, grey scale, unit 6

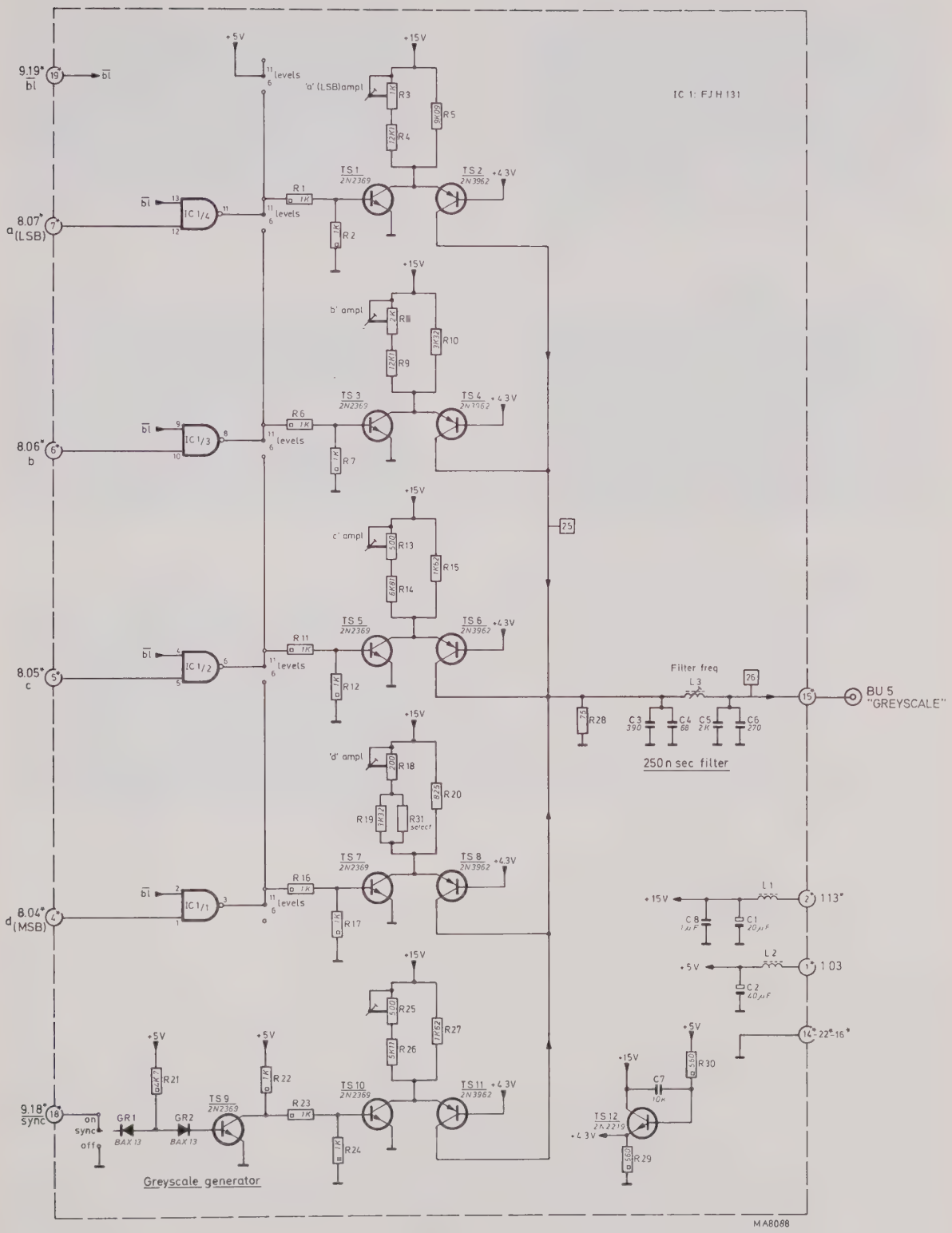


Fig. XIV-6. Circuit diagram, grey scale, unit 6

XV. Unit 7, RCB colour bar

This colourbar generator is similar to the one in unit 4.

The signals are via the 100 ns filters applied to the separate outputs BU9 "R", BU10 "G" and BU11 "B".

Checking and adjusting

Measuring equipment:

Oscilloscope : e.g. PHILIPS PM 3250
Video level meter: e.g. PHILIPS PM 5548

For adjustments in this unit see section: Common adjustments and pulse level adjustments (see Service Instruction, chapter VIII).

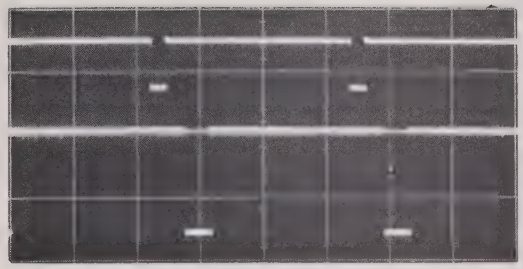
100 ns filters

Connect the oscilloscope to BU9 "R", BU10 "G" and BU11 "B" respectively.
The leading and trailing edges should be 100 ns each.
If not readjust L3, L4 and L5 respectively.

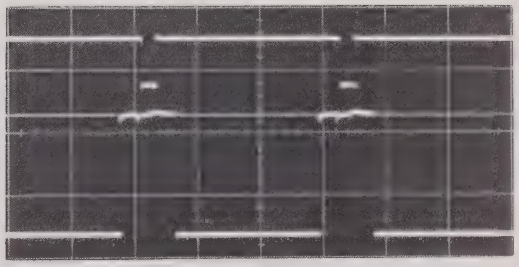
Levels

Connect the Video level meter PM 5548 to BU9 "R", BU10 "G" and BU11 "B" respectively.

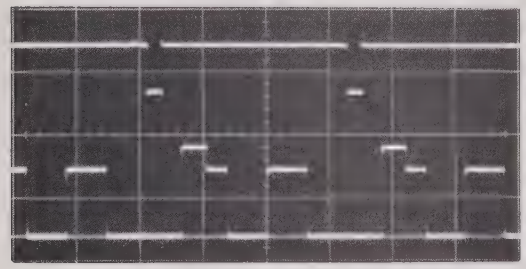
1. Solder EBU - BBC gate jumper at "standard" (for 75 % contrast) and adjust the R-G-B signals to 0.525 V with R11-R18-R25 respectively.
   If 100 % colourbar is required solder the three jumpers for 100 % and adjust the R-G-B signals to 0.700 V.
2. Remove the 100 % jumpers and shift the jumper from "standard" to EBU.
   Adjust the white bar at the R-G-B signals to 0.700 V with R3.
   (If necessary select an other value for R5-R6-R7 respectively).
3. If BBC colourbar is required, shift jumper from EBU to BBC.
   Check the R-G-B amplitudes, they should be 0.525 V - going from 0.175 V to 0.700 V.



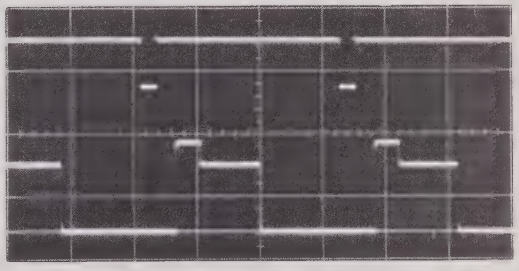
27 2 V/div. reference: $\overline{f_H}$ 20 µs/div.



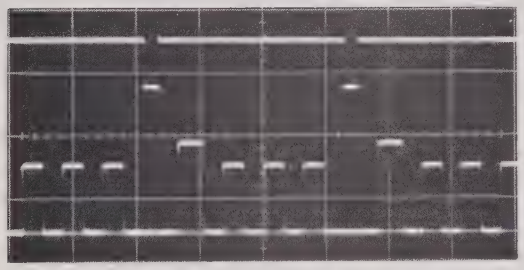
28 2 V/div. reference: $\overline{f_H}$ 20 µs/div.



29 1 V/div. reference: $\overline{f_H}$ 20 µs/div.



30 1 V/div. reference: $\overline{f_H}$ 20 µs/div.



31 1 V/div. reference: $\overline{f_H}$ 20 µs/div.

Fig. XV-1. Oscillograms, unit 7

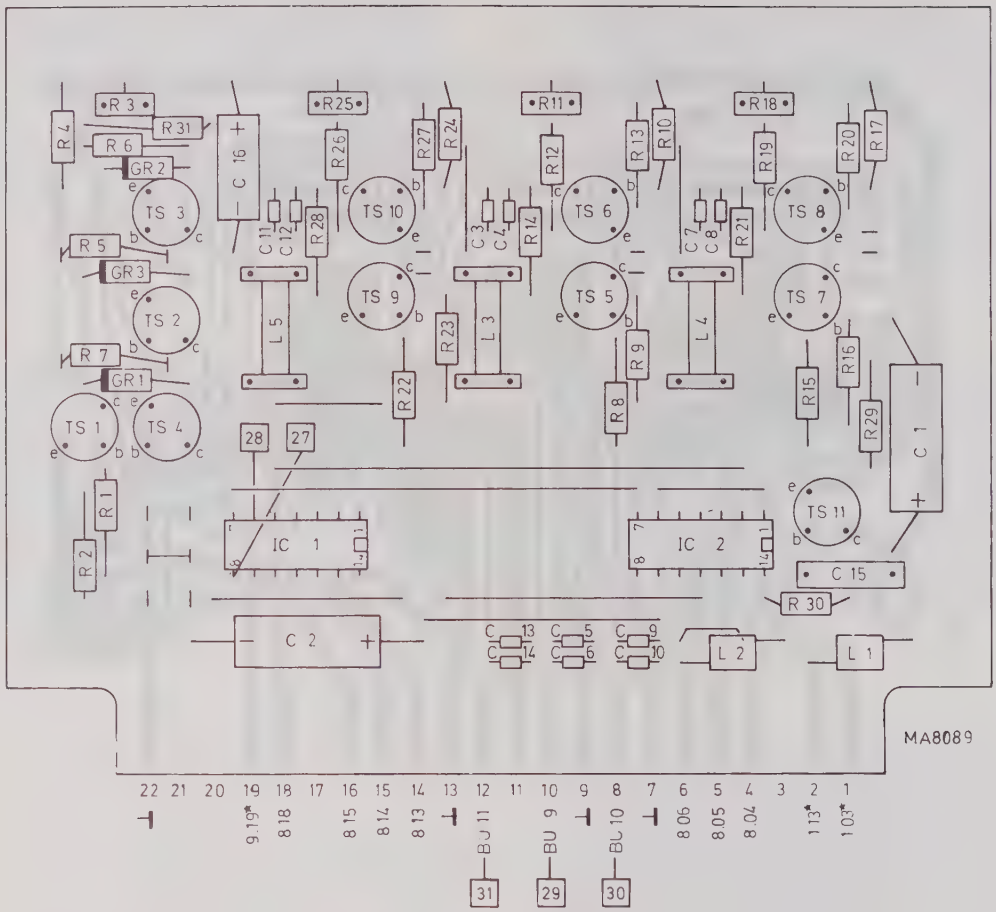


Fig. XV-2. Printed wiring board, RGB colour bar, unit 7

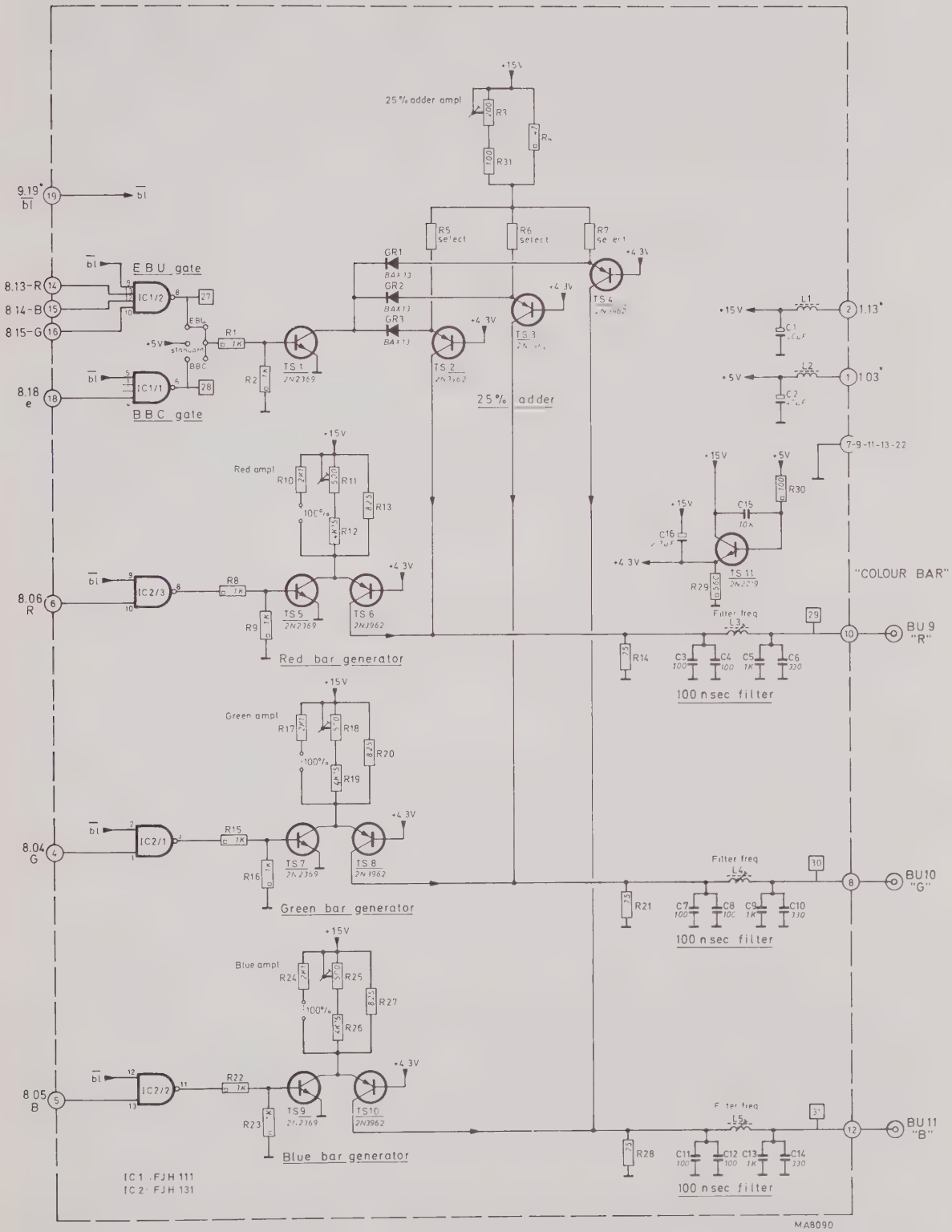


Fig. XV-3. Circuit diagram, RGB colour bar, unit 7

XVI. Unit 8, horizontal divider

This unit contains the "Colourbar generator", the "Staircase control" and the "4:1 divider" controlling the vertical lines "V_L".
The above mentioned circuits are controlled by a horizontal oscillator via a divider system.
The horizontal oscillator TS5-TS6 is a multivibrator whose frequency is controlled by the constant current generator TS8-TS9.

The current through TS8 and thus the frequency of the oscillator depends on the setting of R25 and the mean value of the pulse coming from IC8 "Frequency control".

The working principle of IC8 can be explained with the aid of Fig. XVI-2.
IC8 is reset by the line pulse $\overline{f_H}$*. When all three colour signals R, G, B are low ($\overline{R}$, $\overline{G}$, $\overline{B}$: high) then the next pulse from IC5 (3:1 divider) will shift IC8 to low so that the signals R, G, B are high.
This means that the width of the output pulse depends on the frequency of the oscillator (the broader pulse: the higher frequency and vice versa).

The oscillator is stopped for a period (8,75 μs) during the blanking time (see Fig. XVI-2).
This is controlled by one-shot oscillator TS3-TS4, which is triggered by the line pulse $\overline{f_H}$*.

The $\overline{f_H}$* pulse is generated in the two one-shots IC1/3-TS1 and IC1/1+2 which are triggered by the line sync. pulse $\overline{f_H}$.

One-shot IC1/1+2 determinates the width of the pulse (0,4 μs), while one-shot IC1/3-TS1 controls the delay of the pulse in respect to the line sync. pulse $\overline{f_H}$. This delay can be adjusted by means of R1 "HORIZONTAL POSITION".
Changing of the delay will mean a horizontal shift of the complete pattern as $\overline{f_H}$ controls the start of the horizontal oscillator.

Colourbar generator

The horizontal oscillator is adjusted to supply 72 pulses per active line.
These pulses are applied to the "Colourbar generator" via the two 3:1 dividers IC4 and IC5 (see pulse diagram Fig. XVI-2).
The "Colourbar generator" consists of 3 master-slave flip-flops which are counting the pulses from the 3:1 dividers.
Before the start of the white line of the colourbar signal the flip-flops are set by the "α" pulse.
After the colourbar the flip-flops are reset by the "ω" pulse.
The "α" and "ω" pulses are generated by the "start/stop circuit" IC2.

Greyscale control generator

This generator supplies the control pulses to the greyscale generators in unit 5 and unit 6.
The generator is a counter consisting of 4 master-slave flip-flops.
The clock pulses are applied from the 3:1 divider IC4 via the 2:1 divider IC9/2 (11 levels) or via the extra 2:1 divider IC9/1 (6 levels).
The function of the generator can be seen at the pulse diagram Fig. XVI-3 (11 levels) and Fig. XVI-4 (6 levels).

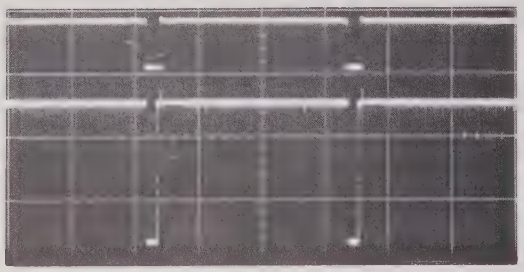
Checking and adjusting

Measuring equipment:
Oscilloscope: e.g. PHILIPS PM 3250

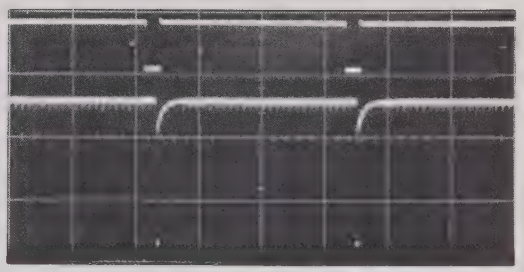
For adjustments in this unit see section: Common adjustments (see Service Instruction chapter VIII).

Horizontal oscillator frequency

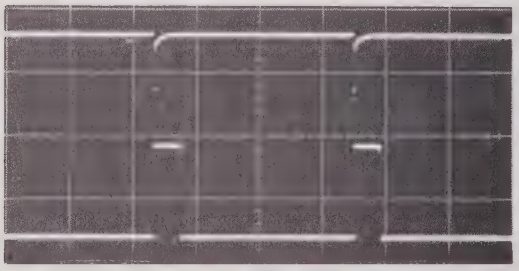
Connect the oscilloscope to IC8 terminal 6.
The width of the pulse should be 4 μs ± 0.1 μs.
If not readjust R25.



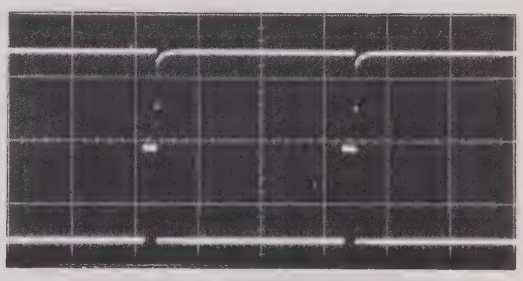
32 2 V/div. 20 µs/div.
reference: $\overline{f_H}$



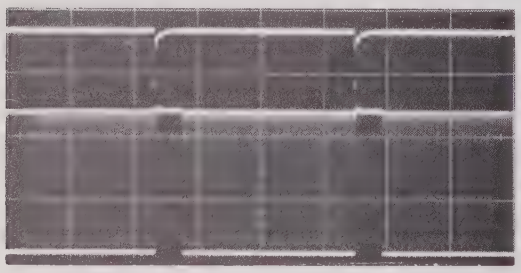
33 2 V/div. 20 µs/div.
reference: $\overline{f_H}$



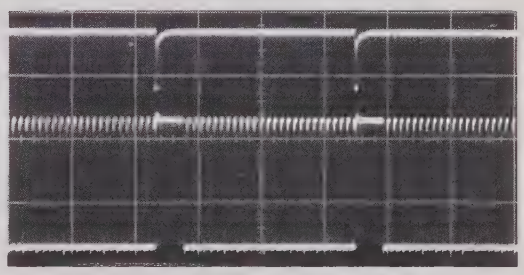
34 10 V/div. 20 µs/div.
reference: $\overline{f_H}$*



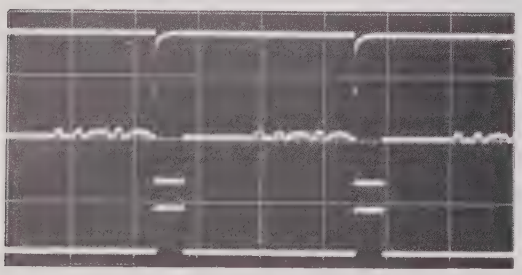
35 0.5 V/div. 20 µs/div.
reference: $\overline{f_H}$*



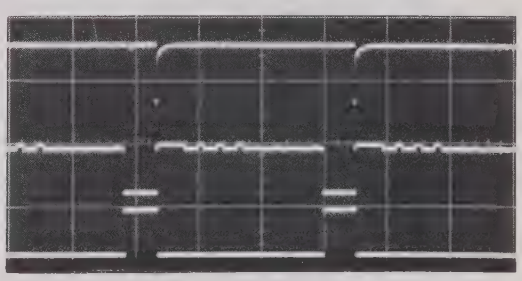
36 2 V/div. 20 µs/div.
reference: $\overline{f_H}$*



37 2 V/div. 20 µs/div.
reference: $\overline{f_H}$*

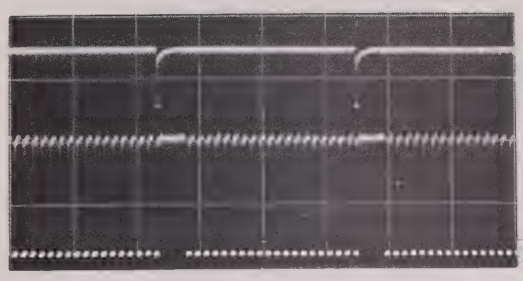


38 5 V/div. 20 µs/div.
reference: $\overline{f_H}$*

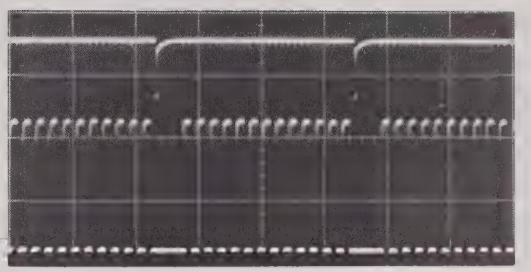


39 5 V/div. 20 µs/div.
reference: $\overline{f_H}$*

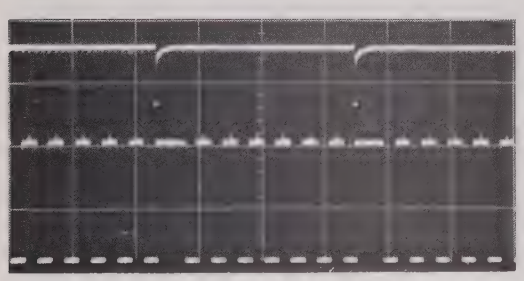
Fig. XVI-1. Oscillograms, unit 8



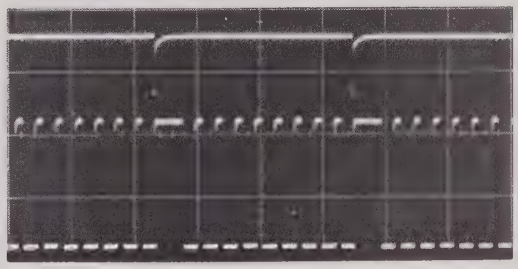
40 2 V/div. reference: $\overline{f_{H*}}$ 20 µs/div.



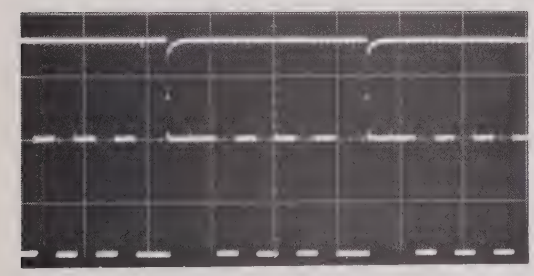
41 2 V/div. reference: $\overline{f_{H*}}$ 20 µs/div.



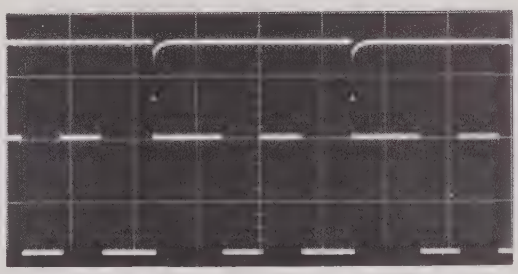
42 2 V/div. reference: $\overline{f_{H*}}$ 20 µs/div.



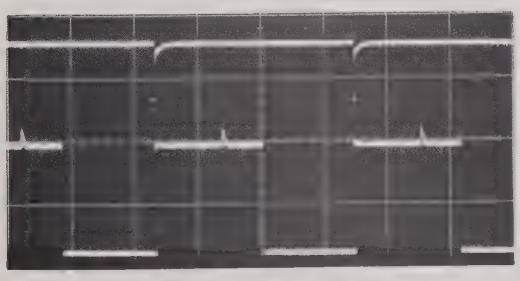
43 2 V/div. reference: $\overline{f_{H*}}$ 20 µs/div.



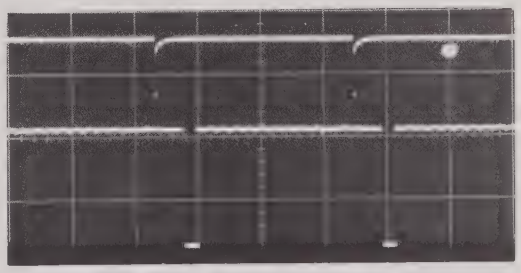
44 2 V/div. reference: $\overline{f_{H*}}$ 20 µs/div.



45 2 V/div. reference: $\overline{f_{H*}}$ 20 µs/div.

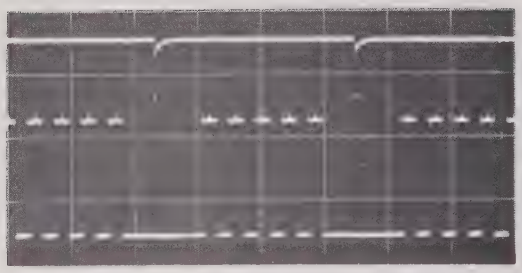


46 2 V/div. reference: $\overline{f_{H*}}$ 20 µs/div.

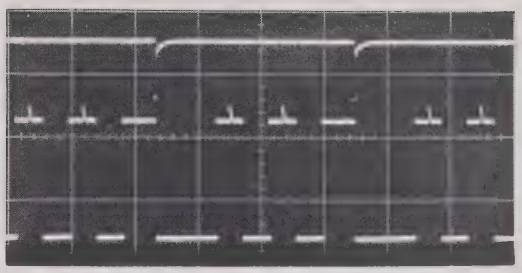


47 2 V/div. reference: $\overline{f_{H*}}$ 20 µs/div.

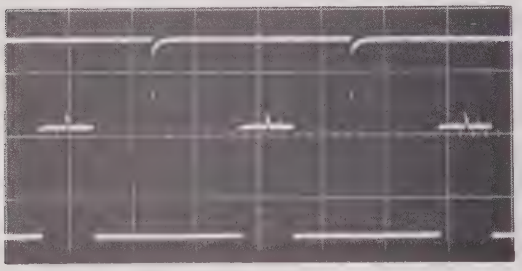
Fig. XVI-1. Oscillograms, unit 8



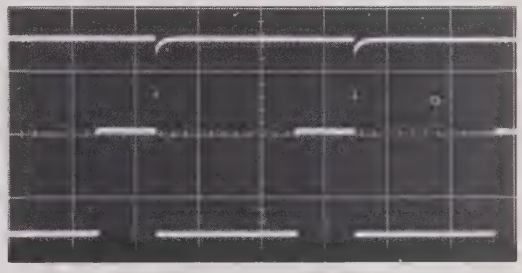
48 2 V/div. 20 μs/div.
reference: $\overline{f_{H*}}$



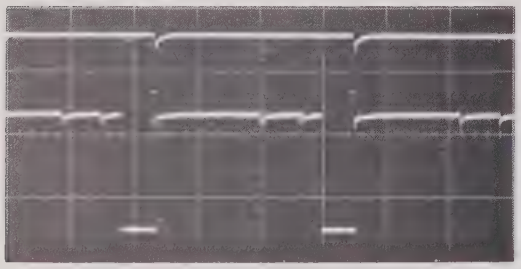
49 2 V/div. 20 μs/div.
reference: $\overline{f_{H*}}$



50 2 V/div. 20 μs/div.
reference: $\overline{f_{H*}}$



51 2 V/div. 20 μs/div.
reference: $\overline{f_{H*}}$



52 2 V/div. 20 μs/div.
reference: $\overline{f_{H*}}$

Fig. XVI-1. Oscillograms, unit 8

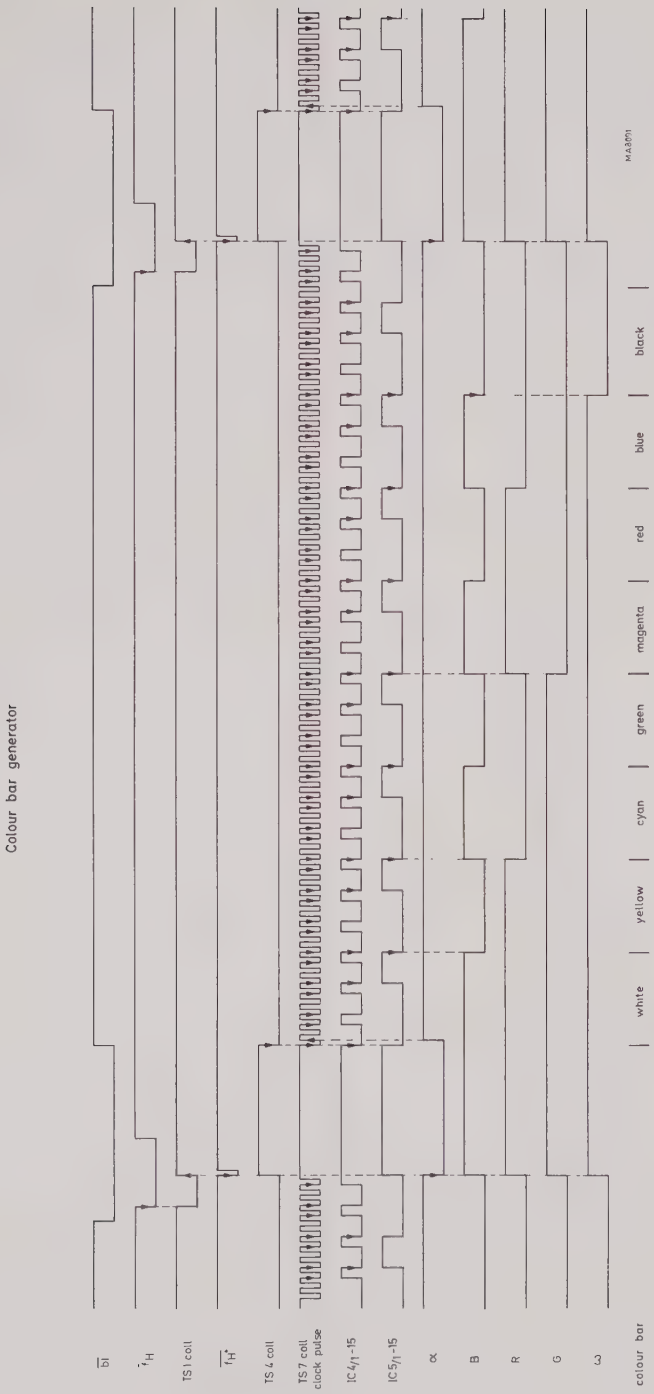


Fig. XVI-2. Pulse diagram of the colour bar generator

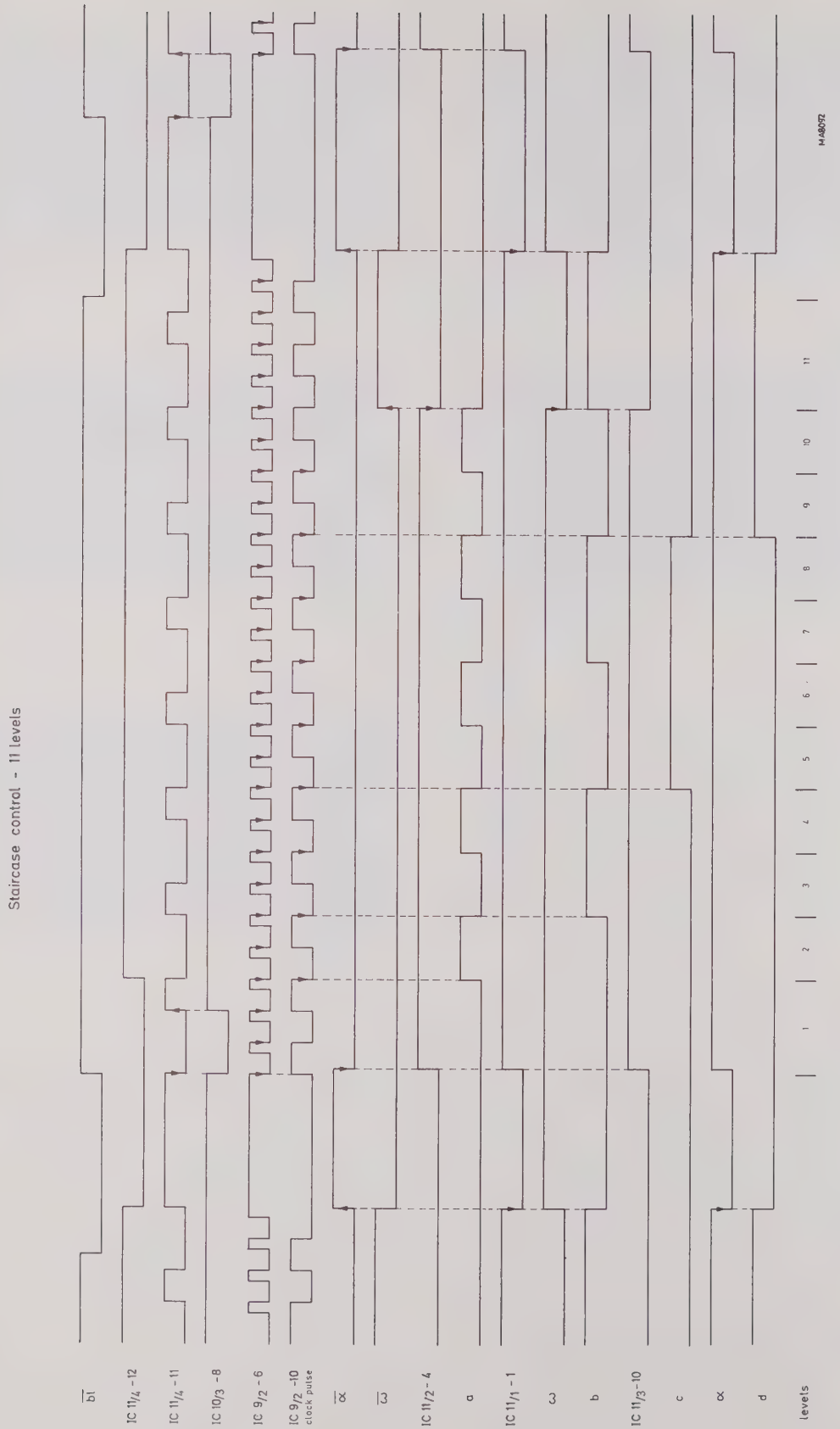


Fig. XVI-3. Pulse diagram of the 11 levels staircase control

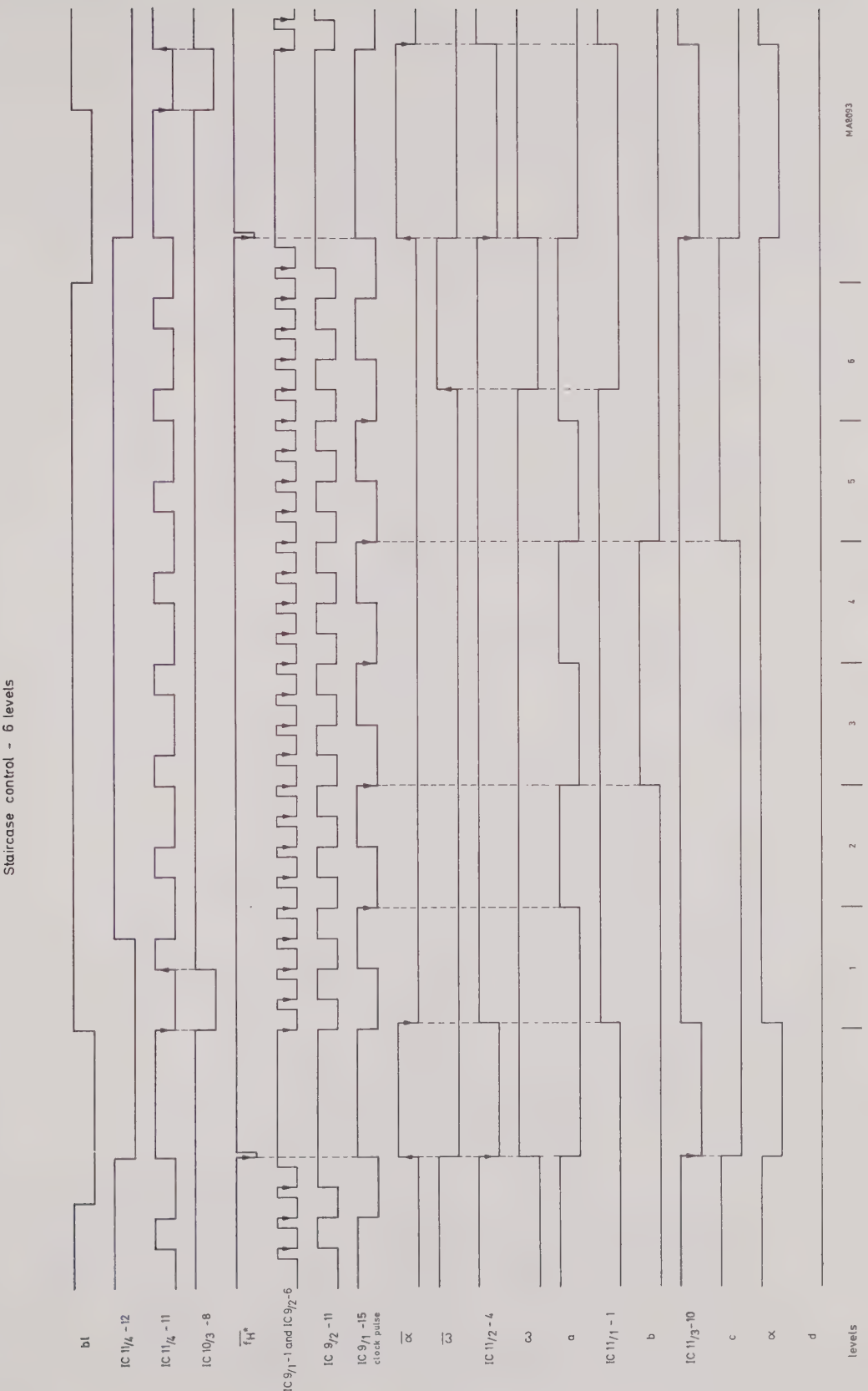


Fig. XVI-4. Pulse diagram of the 6 levels staircase control

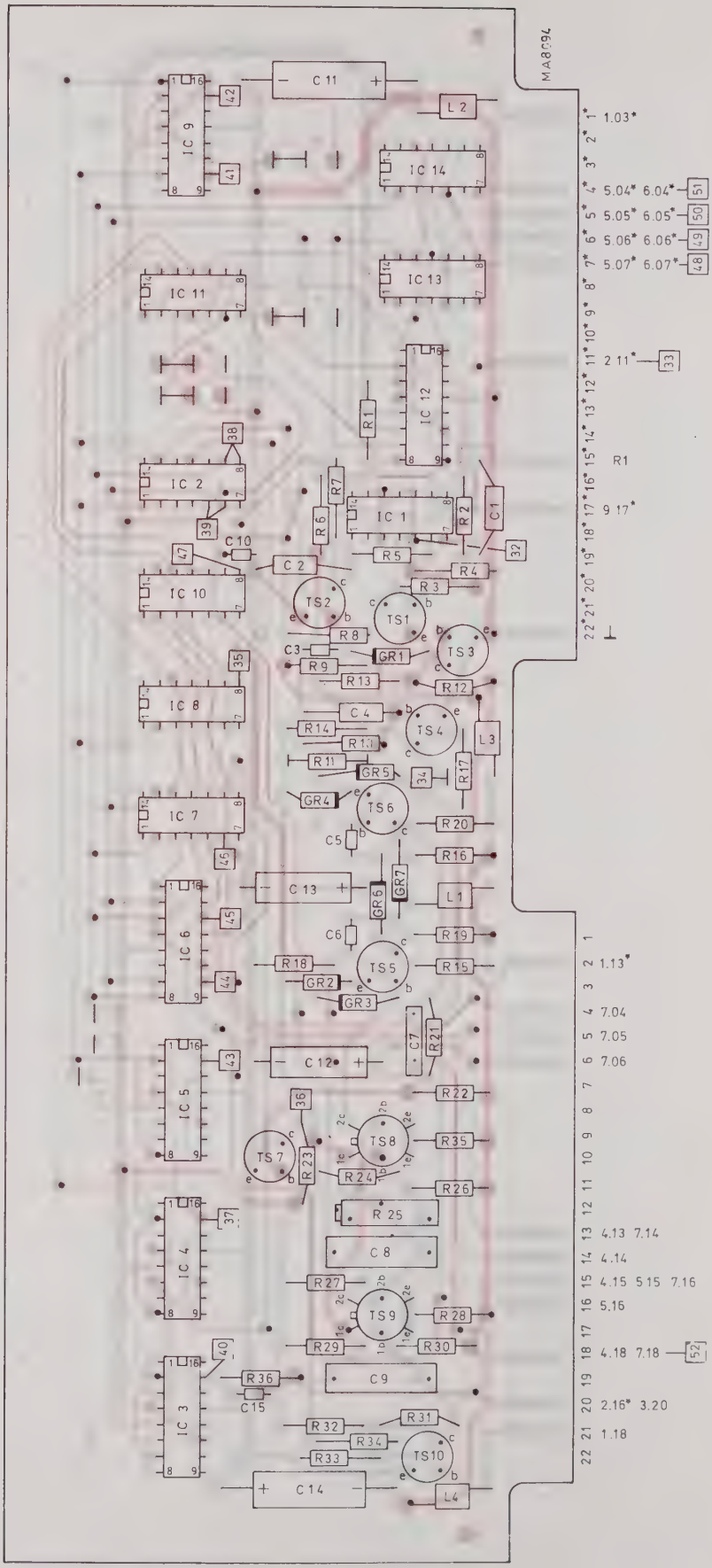


Fig. XVI-5. Printed wiring board, horizontal divider, unit 8

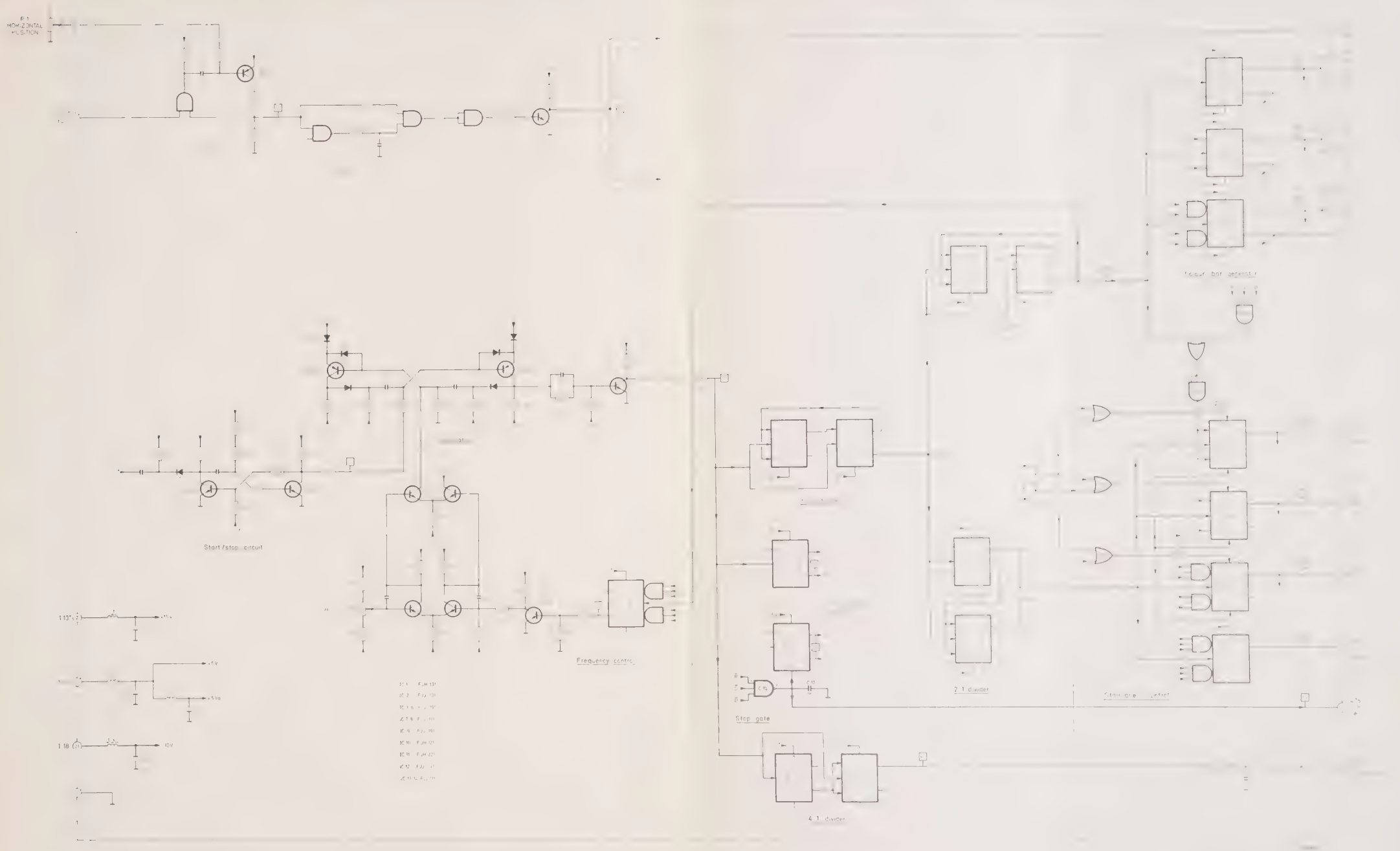


Fig. XVI-6. Circuit diagram, horizontal divider, unit 8

XVII. Unit 9, sync. regenerator (01 version)

This unit consists of two input circuits for:
Composite sync. signal and
burst keying signal.

Input circuit for composite sync. signal

The pulses delivered by a TV-pulse generator are quite accurately specified as regards pulse amplitude and pulse shape. But they may often be considerably distorted by the cable distribution network due to reflections, wrong terminations, cable losses, hum etc..... .
Fig. XVII-2 shows some examples of typical distortions.
These disturbances of the pulses must be suppressed to ensure a proper operation. Therefore the sync. input circuit is provided with special circuits for eliminating the distortions.
The composite sync. signal is applied to TS1 - TS2 via terminal 8. GR1 and GR2 limit the input signal to 15 $V_{p\text{-}p}$.
TS1 and TS2 are emitter-followers offering a high input impedance to the looped through sync. signal and a low impedance to the following stages.
TS3 is clamping the signal during the sync. pulse period, and in this way hum is removed from the signal.
As the voltage across C4 and R8 will adjust itself to half the sync. amplitude, C2 will charge to this level while TS3 is on.

GR3 is compensating for the base-emitter voltage of TS4, which will then limit the sync. pulse at 50 % of the sync. amplitude (see Fig. XVII-2C).
From TS4 the sync. signal is applied via TS5 to the line- and field separator and via TS10 to "FIXED OUTPUTS" generators for: greyscale, cross hatch, PLUGE and white reference.

The line separator IC1/1 and TS12 are supplied with negatively going sync. pulses.
TS12 is normally "on", but for each sync. pulse the IC1/1 will supply a positive jump to the base of TS12, which will drive TS12 into "cut off" position for a period controlled by C11/R31. The connection from junction R32/R33 to the gate input keeps the gate closed until TS12 is conducting again and prevents in this way the pulse generating from being disturbed in the $\overline{\text{field}}$ period.

The $\overline{\text{field}}$ separator IC1/2+3 and TS15-TS16 are also supplied with negatively going sync. pulses (Fig. XVII-3a).
From IC1/3 the pulses (Fig. XVII-3b) are applied to IC1/2 and the one-shot TS15.
The pulses of TS15 (Fig. XVII-3c) are also applied to IC1/2, which will open for only the broad pulses of the one-shot (Fig. XVII-3d), (it is the only moment when both inputs of IC1/2 are positive).
The first pulse of the broad pulses (Fig. XVII-3e) triggers the one-shot TS16 which supplies the $\overline{\text{field}}$ pulse.
The feed-back from TS17 to TS16 prevents spurious signals from triggering the one-shot outside the field blanking time.

Input circuit for blanking signal

Via terminal 6' the blanking signal is applied to the amplifier TS6-TS9 corresponding to the same amplifier in the sync. input.
Here the distorted part of the pulse and the possible hum voltage are also cut-off.

As this sync. regenerator is common for several instruments the unit is supplied with circuits which are not used here, f. inst. the circuit TS11 and the gates controlled by the terminals 11', 13', 14' and 15'.

Checking and adjusting

Measuring equipment:

Oscilloscope: e.g. PHILIPS PM 3330

For adjustment in this unit see section common adjustments (see Service Instructions, chapter VIII).

Checking the $\overline{\text{sync.}}$ pulse

Connect the A amplifier of the oscilloscope to terminal 8'.
Connect the B amplifier to terminal 18'.
These two signals should be of the same width.
The voltage of terminal 18' should be approx. 5 $V_{p\text{-}p}$.

Checking the $\overline{f_H}$ pulse

Connect the oscilloscope to terminal 17'.
The width of the $\overline{f_H}$ pulse should be 4.7 μs ± 10 %.
The voltage should be approx. 5 $V_{p\text{-}p}$.

Checking the $\overline{\text{frame}}$ pulse

Connect the oscilloscope to terminal 16'.
The width of the $\overline{\text{frame}}$ pulse should be 500 - 600 μs.
The voltage should be approx. 5 $V_{p\text{-}p}$.

Checking the $\overline{\text{bl}}$ pulse

Connect the A amplifier of the oscilloscope to terminal 6'.
Connect the B amplifier to terminal 19'.
These two signals should be of the same width.
The voltage of terminal 19' should be approx. 5 $V_{p\text{-}p}$.

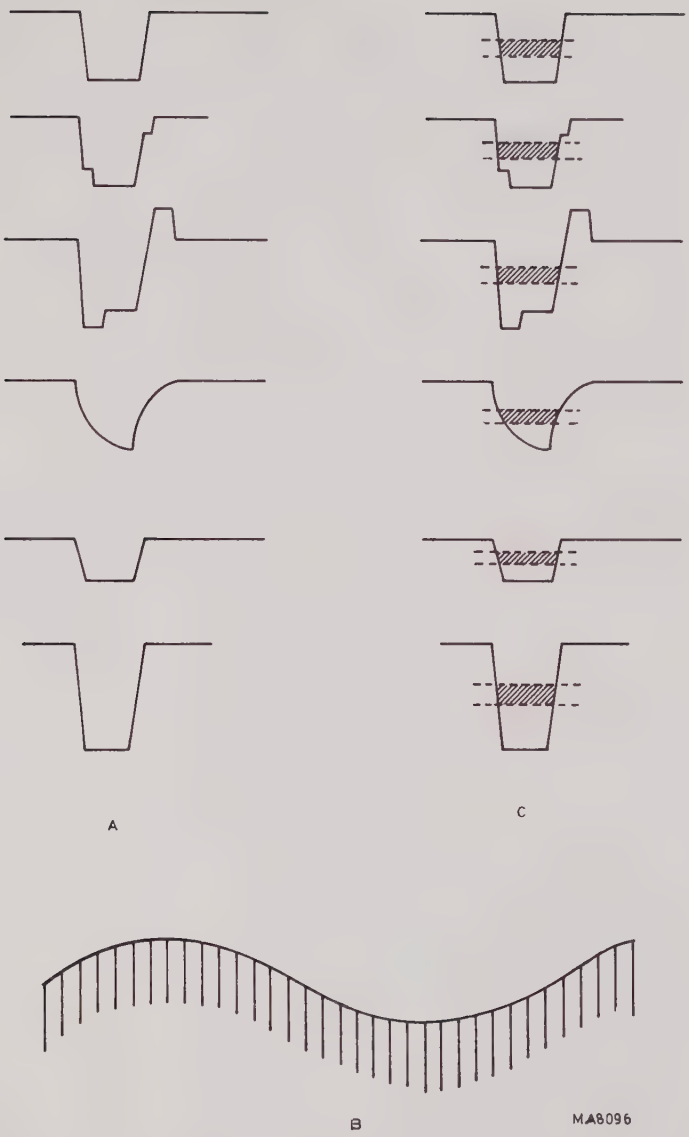


Fig. XVII-1. Pulse diagram of typical distortion

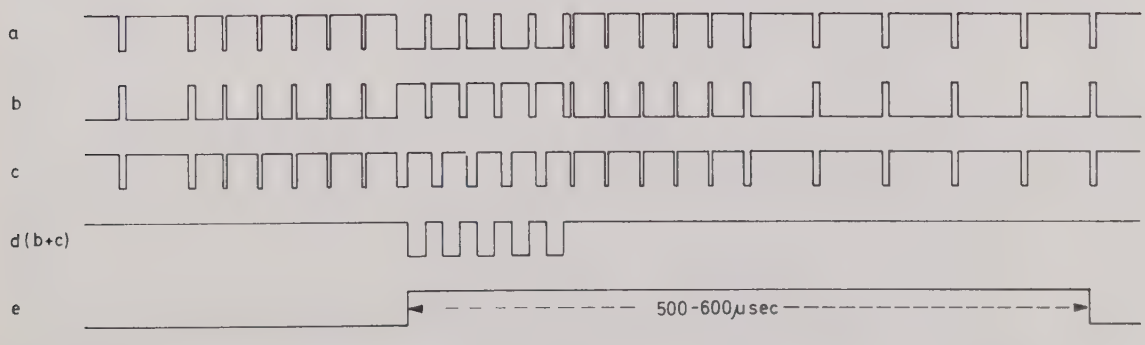


Fig. XVII-2. Pulse diagram of the field blanking

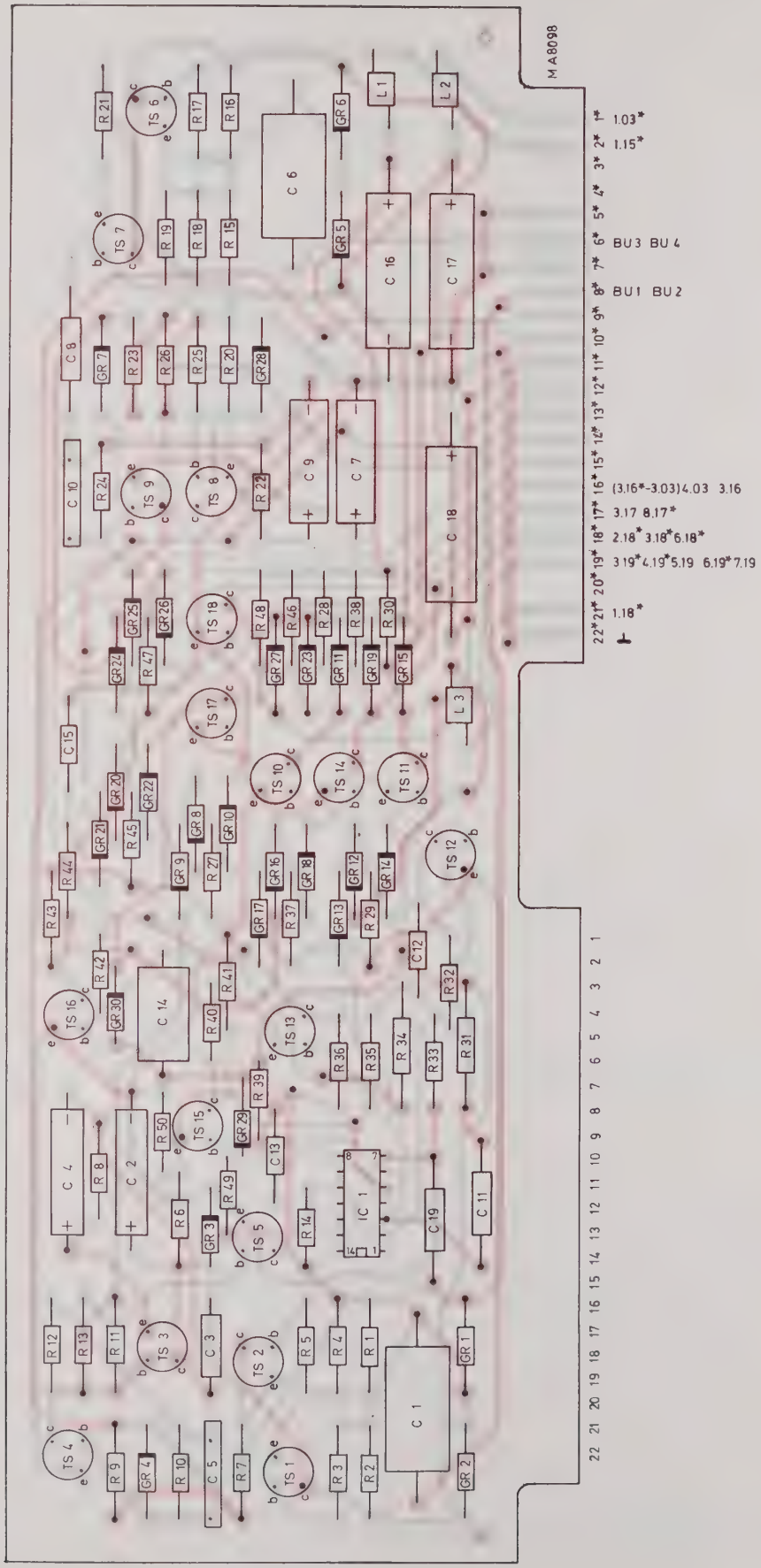


Fig. XVII-3. Printed wiring board, sync. regenerator, unit 9 (01 version)

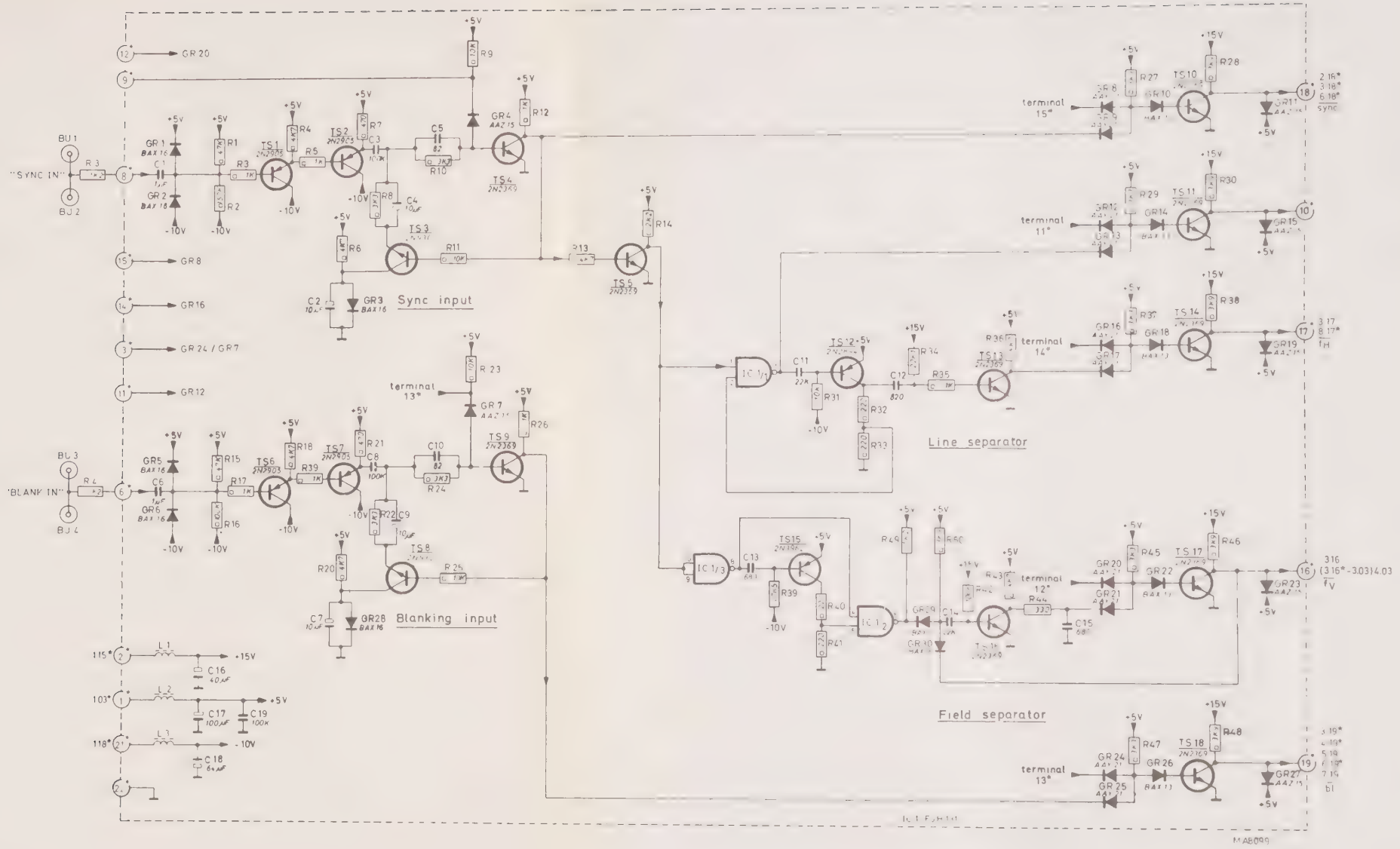


Fig. XVII-4. Circuit diagram, sync. regenerator, unit 9 (01 version)

XVIII. Unit 9, sync. regenerator (02 version)

This unit consists of two output circuits for:
Composite sync. signals and
Blanking signals

Input circuit for composite sync. signal

The composite sync. signal is applied to TS1 via terminal 8*, GR1 and GR2 limit the input signal to 15 $V_{p\text{-}p}$. TS1 and TS2 are emittor-followers offering a high input impedance to the looped through sync. signal and a low output to the following stages.

Voltage divider R4/5 limit the voltage swing at the base of TS2.
TS3 is driven off during the negative going sync. pulses. Between the sync. pulses TS3 is on whereby the signal is clamped and thus removing eventuel hum. The voltage across R12/C4, which adjusts itself to half of the sync. amplitude, is compared with the signal on TS5/TS6 which will limit the sync. pulse at 50 % of the sync. amplitude.

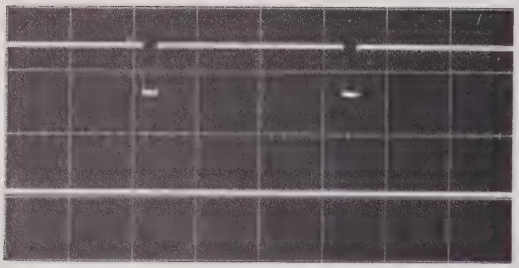
From TS7 the sync. signal is applied via inverter IC4/4, to the line - and field separator and also to terminal 18* for use in the "FIXED OUTPUTS" generators for: grey scale, cross hatch, pluge and white reference.

The line separator consists of the two one shots IC2 and IC3/1.
IC2 has a delay time of 48 μs and IC3/1 a delay time of 4.7 μs. For every negative going pulse from IC4/4, IC2 produce a 48 μs delayed pulse.
IC3/1, which is triggered by the leading edge of the 48 μs delayed pulse, produce a pulse width of 4.7 μs. (TV line pulse, see Fig. XVIII-2a).
The arrangement of the two one shots ensure a minimum period of 48 μs between two trigger pulses of the sync. signal. In this way the equalizing and frame pulses (double the line frequency) are removed so obtaining a continuous chain of line pulses.

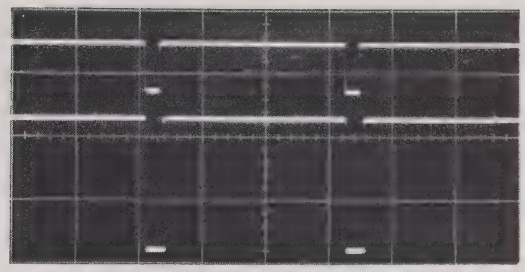
The field separator consists of the two one shots IC3/2 and IC1.
IC3/2 has a delay time of 5.7 μs and IC1 a delay time of 620 μs. The operating principle of this separator is similar to the line separator, but only arranged so to produce a 620 μs field pulse which coincide with the field pulses in the composite sync. signal (see Fig. XVIII-2b).

Input circuit for the blanking signal

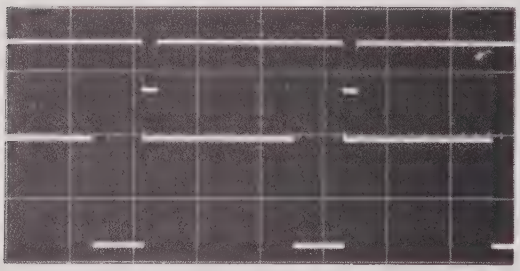
The blanking signal is applied to amplifier TS8 ... TS14 via terminal 6*. The operating principle of this amplifier is similar to the amplifier of the sync. input.



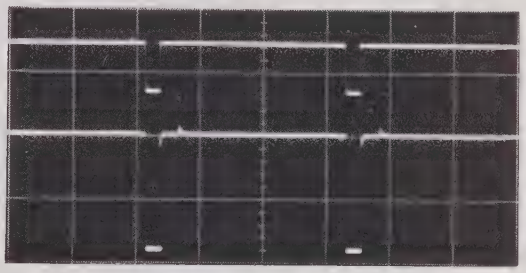
53 2 V/div. 20 µs/div.
reference: "SYNC IN"



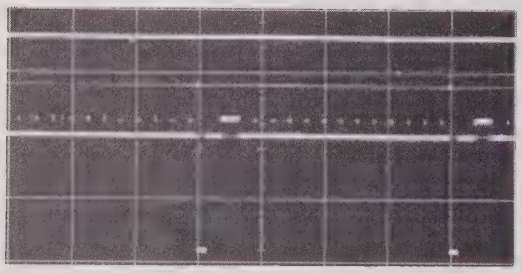
54 2 V/div. 20 µs/div.
reference: "SYNC IN"



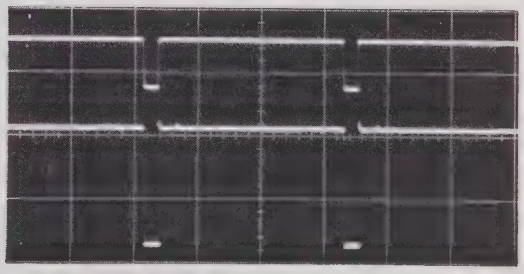
55 2 V/div. 20 µs/div.
reference: "SYNC IN"



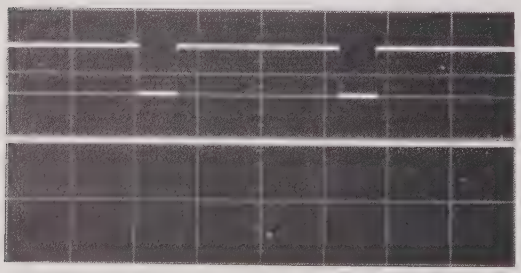
56 2 V/div. 20 µs/div.
reference: "SYNC IN"



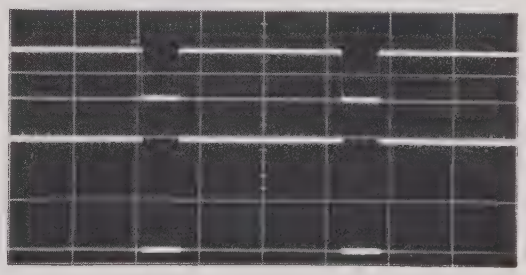
57 2 V/div. 5 ms/div.
reference: "SYNC IN"



58 2 V/div. 20 µs/div.
reference:"SYNC IN"



59 2 V/div. 20 µs/div.
reference: "BLANK IN"



60 2 V/div. 20 µs/div.
reference: "BLANK IN"

Fig. XVIII-1. Oscillograms, unit 9

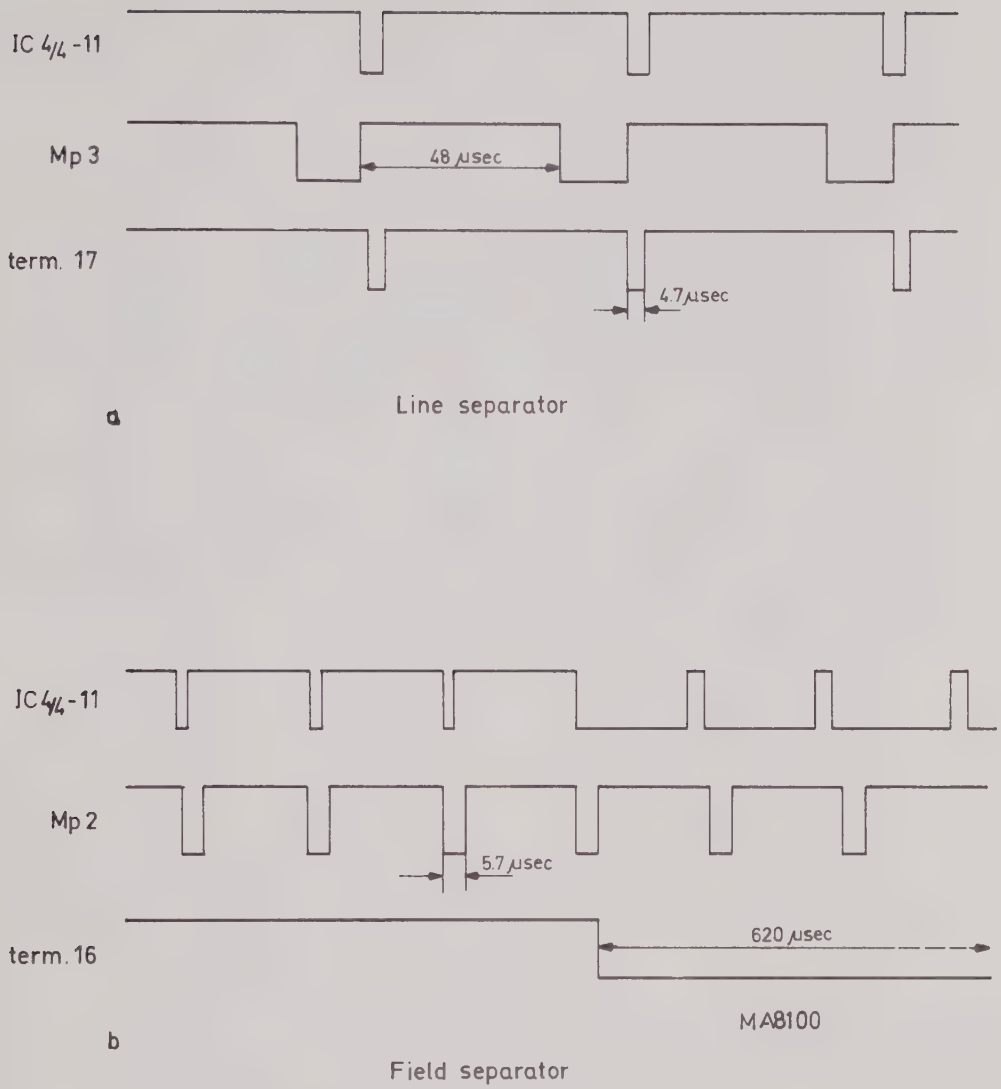


Fig. XVIII-2. Pulse diagram, line and field-separators

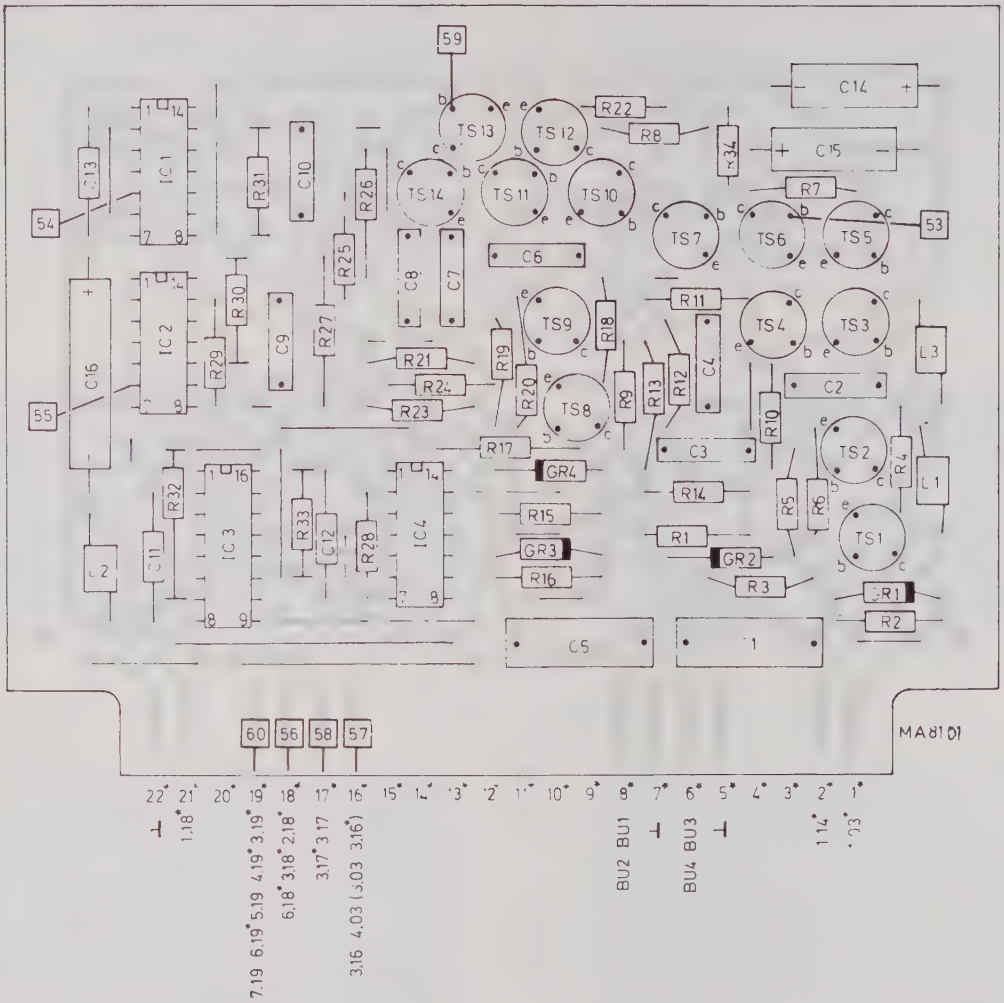


Fig. XVIII-3. Printed wiring board, sync. regenerator, unit 9 (02 version)

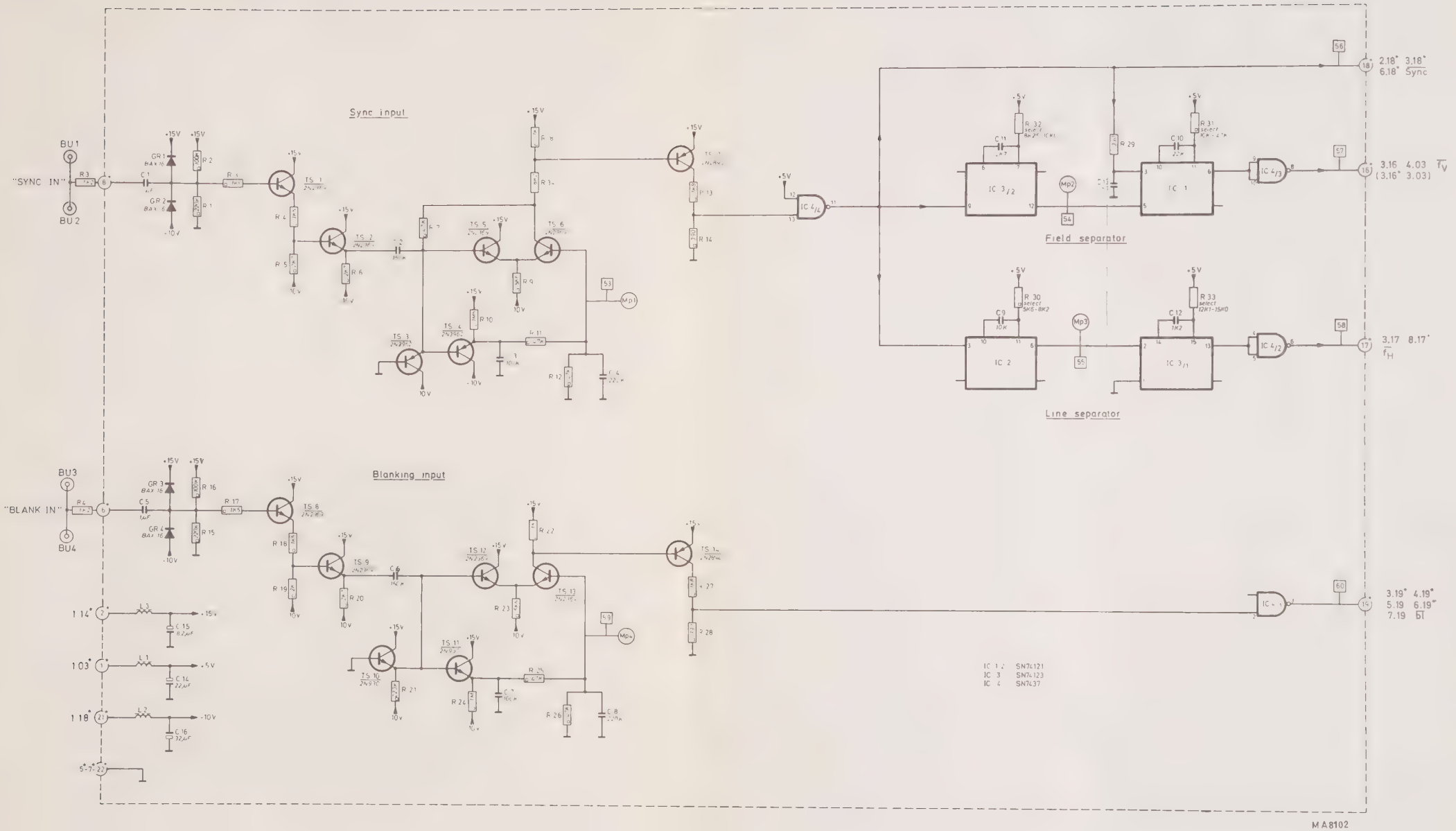


Fig. XVIII-4. Circuit diagram, sync. regenerator, unit 9 (02 version)

XIX. Access to and replacement of parts

A. Removing the chassis (see Fig. XIX-1)

1. Loosen the two screws "A".
2. Turn the two locking brackets "B" forward.
3. Pull out the chassis.

B. Removing the textplate (see Fig. XIX-1)

1. Remove the chassis as indicated in section A.
2. Remove the screws underside of the locking brackets "B".
3. Remove the fixing nut which holds the mains switch.
4. Loosen the pilot lampholder.
5. Loosen the fuseholder.
6. The text plate can be removed.
   Now the pushbutton switches and potentiometers are accessible.

Fig. XIX-1. Front of the instrument

XX. Maintenance

A. Switches

Should the switches cease to function properly due to dirty contacts, they should be treated with switch oil (see list of mechanical parts).
This oil has both cleaning and lubricating properties.
After using this oil, the switch should be operated a few times.

B. Cabinet

The P.V.C. coated cabinet can be cleaned with soap and water (first remove chassis, chapter XIX).
If necessary, a fine scouring detergent can be used.

XXI. List of mechanical parts

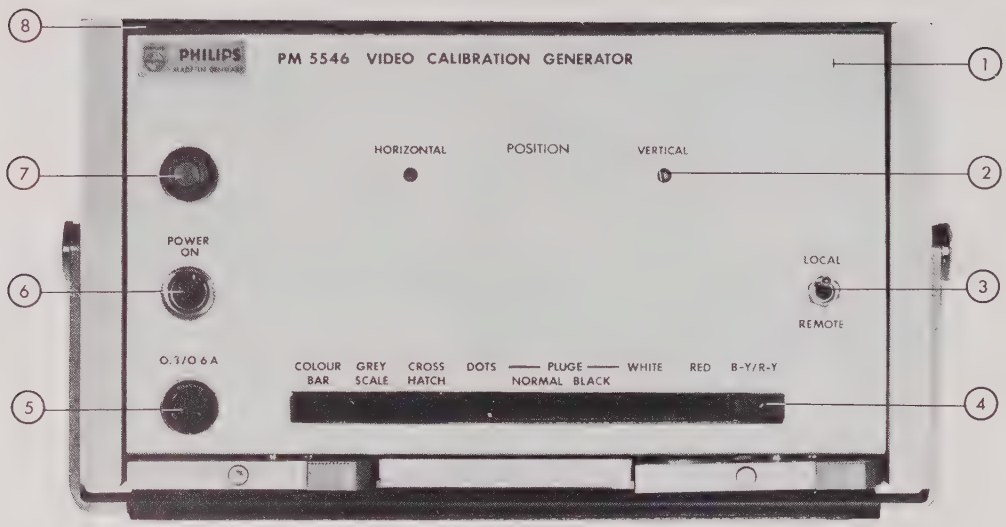


Fig. XXI-1. Front of the instrument

A. Mechanical

Item	*Quantity*	*Description*	*Ordering number*
1	1	Textplate	5322 455 74013
2	1	Switch	5322 273 44016
3	1	Switch	5322 277 24004
4	1	Push-button switch	5322 276 84023
5	1	Fuse holder	5322 256 40039
5	1	Fuse 230 V/T315 mA	5322 253 30014
5	1	Fuse 115 V T630 mA	5322 253 30018
6		Mains switch	5322 277 10226
7		Lampholder	5322 255 10078
7		Pilot lamp 6 V - 50 mA	5322 134 40264
8	1	Ornamental strip (19")	5322 460 60025

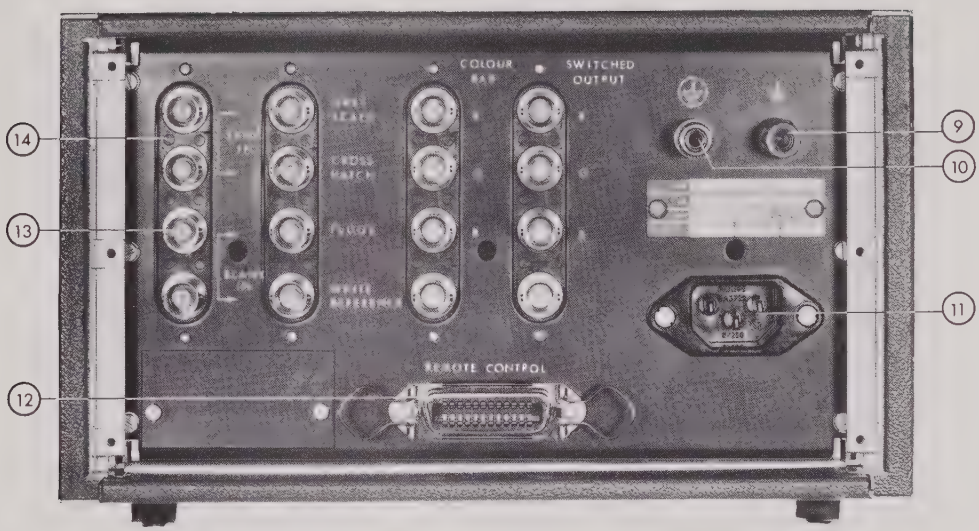


Fig. XXI-2. Rear of the instrument

Item	*Quantity*	*Description*	*Ordering number*
9	1	Earth connector (electrical)	5322 290 40012
10	1	Earth connector (chassis)	5322 290 40011
11	1	Mains socket	5322 265 30066
12	1	Multiplug	5322 267 60035
13	16	BNC socket	5322 267 10004
14	4	Connector plate	5322 466 90687
	4	BNC connector	5322 265 10003
	1	Mains flex	5322 321 10071
	2	75 Ω connector 0.1 %	5322 263 60033
	2	Guide part	5322 462 30111
	2	Contact block	5322 267 60023
	1	Coaxial cable (75 Ω)	4822 320 10028
	1	10 CC of switch coil	4822 390 10007

XXII. List of electrical parts

This parts list does not contain multi-purpose and standard parts. These components are indicated in the circuit diagram by means of identification marks. The specification can be derived from the survey below.

Diese Ersatzteilliste enthält keine Universal- und Standard-Teile. Diese sind im jeweiligen Prinzipschaltbild mit Kennzeichnungen versehen. Die Spezifikation kann aus nachstehender Übersicht abgeleitet werden.

In deze stuklijst zijn geen universele en standaardonderdelen opgenomen. Deze componenten zijn in het principeschema met een merkteken aangegeven. De specificatie van deze merktekens is hieronder vermeld.

La présente liste ne contient pas des pièces universelles et standard. Celles-ci ont été repérées dans le schéma de principe. Leurs specifications sont indiquées ci-dessous.

Esta lista de componentes no comprende componentes universales ni standard. Estos componentes están provistos en el esquema de principio de una marca. El significado de estas marcas se indica a continuación.

Carbon resistor E24 series
Kohleschichtwiderstand, Reihe E24
Koolweerstand E24 reeks
Résistance au carbone, série E24
Resistencia de carbón, serie E24
0,125 W 5%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12
0,25 W ≦ 1 MΩ, 5%
> 1 MΩ, 10%

Carbon resistor E24 series
Kohleschichtwiderstand, Reihe E24
Koolweerstand E24 reeks
Résistance au carbone, série E24
Resistencia de carbón, serie E24
0,5 W ≦ 5 MΩ, 1%
> 5 ≦ 10 MΩ, 2%
> 10 MΩ, 5%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12
0,5 W ≦1,5MΩ, 5%
>1,5MΩ, 10%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12
1 W ≦2,2 MΩ, 5%
>2,2 MΩ, 10%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12
2 W 5%

Wire-wound resistor
Drahtwiderstand
Draadgewonden weerstand
Résistance bobinée
Resistencia bobinada
0,4 – 1,8 W 0,5%

Wire-wound resistor
Drahtwiderstand
Draadgewonden weerstand
Résistance bobinée
Resistencia bobinada
5,5 W ≦200 Ω, 10%
>200 Ω, 5%

Wire-wound resistor
Drahtwiderstand
Draadgewonden weerstand
Résistance bobinée
Resistencia bobinada
10 W 5%

Tubular ceramic capacitor
Rohrkondensator
Keramische kondensator, buistype
Condensateur céramique tubulaire
Condensador cerámico tubular
500 V

Tubular ceramic capacitor
Rohrkondensator
Keramische kondensator, buistype
Condensateur céramique tubulaire
Condensador cerámico tubular
700 V

Ceramic capacitor, "pin-up"
Keramikkondensator "Pin-up" (Perltyp)
Keramische kondensator "Pin-up" type
Condensateur céramique, type perle
Condensador cerámico, versión "colgable"
500 V

"Microplate" ceramic capacitor
Miniatur-Scheibenkondensator
"Microplate" keramische kondensator
Condensateur céramique "microplate"
Condensador cerámico "microplaca"
30 V

Mica capacitor
Glimmerkondensator
Micakondensator
Condensateur au mica
Condensador de mica
500 V

Polyester capacitor
Polyesterkondensator
Polyesterkondensator
Condensateur au polyester
Condensador polyester
400 V

Flat-foil polyester capacitor
Miniatur-Polyesterkondensator (flach)
Platte miniatuur polyesterkondensator
Condensateur au polyester, type plat
Condensador polyester, tipo de placas planas
250 V

Paper capacitor
Papierkondensator
Papierkondensator
Condensateur au papier
Condensador de papel
1000 V

Wire-wound trimmer
Drahttrimmer
Draadgewonden trimmer
Trimmer à fil
Trimmer bobinado

Tubular ceramic trimmer
Rohrtrimmer
Buisvormige keramische trimmer
Trimmer céramique tubulaire
Trimmer cerámico tubular

For multi-purpose and standard parts, please see PHILIPS' Service Catalogue.
Für die Universal- und Standard-Teile siehe den PHILIPS Service-Katalog.
Voor universele en standaardonderdelen raadplege men de PHILIPS Service Catalogus.
Pour les pièces universelles et standard veuillez consulter le Catalogue Service PHILIPS.
Para piezas universales y standard consulte el Catálogo de Servicio PHILIPS.

Print panels

Unit	*Description*	*Print number*	*Ordering number*
1	Voltage regulator	4008 108 77180	5322 216 64035
2	Pluge	4008 108 77170	5322 216 64036
3	Cross Hatch-Dots	4008 108 77160	5322 216 64037
4	Switchable output I	4008 108 77150	5322 216 64038
5	Switchable output II	4008 108 77140	5322 216 64039
6	Grey scale	4008 108 77130	5322 216 64041
7	RGB colourbar	4008 108 77120	5322 216 64042
8	Horizontal divider	4008 108 77110	5322 216 64043
9	Sync. regenerator (01 version)	4008 108 75370	5322 216 60169
9	Sync. regenerator (02 version)	4008 108 77550	5322 216 64072
10	Rectifier unit	4008 108 75380	5322 216 60171
	Extension board	4008 108 75620	5322 263 70055
	Extension board	4008 108 76320	5322 263 70057

Semi-conductors

Type	*Ordering number*	*Type*	*Ordering number*
2N930	5322 130 40051	AAY21	5322 130 30087
2N2219	5322 130 40496	AAZ15	5322 130 30229
2N2369	5322 130 40407	BAX13	5322 130 40182
2N2453	5322 130 44023	BAX16	5322 130 30273
2N2894	5322 130 40018	BZY88/C6V8	5322 130 30079
2N2905	5322 130 40021	BZY88/C7V5	5322 130 30287
2N3055	5322 130 40132		
2N3962 (BCY71)	5322 130 40373		

Integrated circuits

Type	*Ordering number*
FJH101	5322 209 80106
FJH111	5322 209 80024
FJH121	5322 209 80062
FJH131	5322 209 80023
FJH221	5322 209 80128
FJH261	5322 209 84123
FJJ111	5322 209 80107
FJJ121	5322 209 80108
FJJ131	5322 209 80065
FJJ141	5322 209 80061
FJJ211	5322 209 84027
FJJ191	5322 209 80127
FJK101/74121N	5322 209 84122
SN7437	5322 209 84195
SN74123	5322 209 84194

Diagram number	*Description*	*Value*	*W/V*	*Ordering number*
T1	Transformer			5322 146 40185
R1	Potentiometer	3.3 kΩ		5322 103 20099
Unit 1				
C1	Capacitor	1 kpF		4822 120 20107
C2-4-6	Capacitor	10 kpF		4822 120 20134
C3-5	Capacitor	4.7 kpF		4822 120 21125
C7	Electrolytic cap.	8 µF	40 V	5322 124 24013
C8	Electrolytic cap.	20 µF	16 V	5322 124 24012
C9	Electrolytic cap.	40 µF	6.4 V	5322 124 24027
C10	Electrolytic cap.	32 µF	10 V	5322 124 24021
R6-32	Resistor	2.21 kΩ	1 %	5322 116 50968
R8	Resistor	1.1 Ω	1/4 %	5322 116 50518
R11	Resistor	1.2 Ω	10 %	5322 113 60102
R12-24-34	Resistor	1.82 kΩ	1 %	5322 116 50781
R13	Resistor	20 kΩ	1 %	5322 116 50332
R17-20	Resistor	2.67 kΩ	1 %	5322 116 50867
R20	Resistor	2.43 kΩ	1 %	5322 116 50971
R20	Resistor	3010 Ω	1 %	5322 116 50806
R21	Resistor	470 Ω	1 %	5322 116 50975
R23	Resistor	1 Ω	10 %	5322 113 60062
R25	Resistor	13 kΩ	1 %	5322 116 50522
R29	Resistor	3.32 kΩ	1 %	5322 116 54005
R32	Resistor	2.21 kΩ	1 %	5322 116 50968
R33	Resistor	2.2 Ω	1 %	5322 113 60079
R35	Resistor	26.7 kΩ	1 %	5322 116 50364
Unit 2				
C1	Capacitor	3.3 kpF		5322 121 54011
C2	Capacitor	2.7 kpF		5322 121 54006
C3	Capacitor	1.2 kpF		5322 121 50439
C4	Capacitor	3.9 kpF		5322 122 30098
C5	Capacitor	390 pF		5322 122 30091
C6	Capacitor	68 pF		5322 122 30023
C7	Capacitor	2.7 kpF		4822 122 30057
C8	Capacitor	270 pF		5322 122 30107
C9	Electrolytic cap.	40 µF	6.4 V	5322 124 24027
C10	Electrolytic cap.	20 µF	16 V	5322 124 24012
R1	Resistors	15 kΩ	1 %	5322 116 54001
R1	Resistor	16.2 kΩ	1 %	5322 116 50593
R1	Resistor	18.2 kΩ	1 %	5322 116 50897
R2	Resistor	6.81 kΩ	1 %	5322 116 54012
R2	Resistor	7.5 kΩ	1 %	5322 116 50151
R2	Resistor	8.25 kΩ	1 %	5322 116 50979
R3	Resistor	10 kΩ	1 %	5322 116 50748
R3	Resistor	11 kΩ	1 %	5322 116 51056
R3	Resistor	12.1 kΩ	1 %	5322 116 50572
R5	Potentiometer	500 Ω		5322 100 10148
R6	Resistor	3.32 kΩ	1 %	5322 116 54005
R6	Resistor	3.57 kΩ	1 %	5322 116 50614
R6	Resistor	3.92 kΩ	1 %	5322 116 50911
R7	Resistor	619 Ω	1 %	5322 116 50977
R10-14	Potentiometer	10 kΩ		5322 101 14012

Diagram number	*Description*	*Value*	*W/V*	*Ordering number*
R18	Potentiometer	1 kΩ		5322 100 10129
R19	Resistor	4.75 kΩ	1 %	5322 116 54008
R19	Resistor	5.11 kΩ	1 %	5322 116 50762
R19	Resistor	5.62 kΩ	1 %	5322 116 54011
R20	Resistor	1.62 kΩ	1 %	5322 116 50949
R21	Resistor	75 Ω	0.5 %	5322 116 50918
L1	Coil	7.44 µH		5322 156 24035
L2-L3	Coil			5322 158 10052
Unit 3				
C1	Capacitor	10 kpF		5322 121 54018
C2-4-5-9-10	Capacitor	100 pF		5322 122 30021
C3	Capacitor	3.9 kpF		5322 122 30098
C6-11	Capacitor	1 kpF		5322 122 30027
C7-12	Capacitor	330 pF		5322 122 34005
C8	Capacitor	2.7 kpF		5322 121 54006
C13	Capacitor	100 kpF		5322 122 40323
C14	Electrolytic cap.	64 µF	6.4 V	5322 124 24072
C15	Electrolytic cap.	32 µF	16 V	5322 124 24073
R1	Resistor	24.3 kΩ	1 %	5322 116 50939
R2-5-14	Resistor	3.57 kΩ	1 %	5322 116 50614
R4-9-19	Potentiometer	1 kΩ		5322 100 10129
R5	Resistor	3010 kΩ	1 %	5322 116 50524
R5	Resistor	3.32 kΩ	1 %	5322 116 54005
R6-16	Resistor	619 Ω	1 %	5322 116 50977
R10-18	Resistor	4.75 kΩ	1 %	5322 116 54008
R10-18	Resistor	5.11 kΩ	1 %	5322 116 50762
R10-18	Resistor	5.62 kΩ	1 %	5322 116 54011
R11-20	Resistor	1.62 kΩ	1 %	5322 116 50949
R12-22	Resistor	75 Ω	0.5 %	5322 116 50918
R14	Resistor	3.92 kΩ	1 %	5322 116 50911
R15	Potentiometer	200 Ω		5322 130 10118
R25	Resistor	9.53 kΩ	1 %	5322 116 50915
L1-2	Coil	3.25 µH		5322 156 24036
L3-4	Coil			5322 158 10052
Unit 4				
C1	Electrolytic cap.	20 µF	16 V	5322 124 24012
C2	Electrolytic cap.	40 µF	6.4 V	5322 124 24027
C3	Capacitor	39 kpF		5322 122 30098
R3-6-9-51-58-65	Potentiometer	500 Ω		5322 100 10148
R4-7-10	Resistor	3.92 kΩ	1 %	5322 116 50911
R5-8-11	Resistor	619 Ω	1 %	5322 116 50977
R18-21-24-29-32-35	Potentiometer	10 kΩ		5322 101 14012
R38-41-44	Potentiometer	5 kΩ		5322 100 10036
R39-42-45	Resistor	15 kΩ	1 %	5322 116 54001
R40-43-46	Resistor	2.43 kΩ	1 %	5322 116 50971
R50-57-64	Resistor	2.21 kΩ	1 %	5322 116 50968
R52-57-64	Resistor	5.62 kΩ	1 %	5322 116 54011
R53-60-67	Resistor	825 Ω	1 %	5322 116 50978

Diagram number	*Description*	*Value*	*W/V*	*Ordering number*
Unit 5				
C1	Electrolytic cap.	20 µF	16 V	5322 124 24012
C2	Electrolytic cap.	40 µF	6.4 V	5322 124 24027
C3-4	Capacitor	100 pF		5322 122 30021
C5-9-13	Capacitor	1 kpF		5322 122 30027
C6	Capacitor	330 pF		5322 122 34005
C15	Capacitor	3.9 kpF		5322 122 30098
C7-8-12	Capacitor	400 pF		5322 121 54017
C10-14	Capacitor	330 pF		5322 121 50369
R3-6-19-14-19-29-34-37-40	Potentiometer	1 kΩ		5322 100 10129
R4-7-10-20-30-47-50-53	Resistor	3.32 kΩ	1 %	5322 116 54005
R5-8-11-21	Resistor	619 Ω	1 %	5322 116 50977
R15	Resistor	12.1 kΩ	1 %	5322 116 50272
R16	Resistor	1.82 kΩ	1 %	5322 116 50781
R24	Potentiometer	10 kΩ		5322 101 14012
R25	Resistor	26.7 kΩ	1 %	5322 116 50784
R26	Resistor	3.92 kΩ	1 %	5322 116 50911
R35-38-41-46-49-52	Resistor	13 kΩ	1 %	5322 116 50522
R36-39-42	Resistor	9090 Ω	1 %	5322 116 50537
R45-48-51	Potentiometer	2 kΩ		5322 100 14015
R56-59-62	Potentiometer	500 Ω		5322 100 10148
R57-60-68	Resistor	7.5 kΩ	1 %	5322 116 50151
R58-61-64	Resistor	1.62 kΩ	1 %	5322 116 50949
R67-70-73	Potentiometer	200 Ω		5322 100 10155
R68-71-74	Resistor	3.57 kΩ	1 %	5322 116 50614
R69-72-75	Resistor	825 Ω	1 %	5322 116 50978
R76-77-78	Resistor	75 Ω	1 %	5322 116 50918
L1-2	Coil			5322 158 10052
L3-5	Coil	3.25 µH		5322 156 24036
Unit 6				
C1	Electrolytic cap.	20 µF	16 V	5322 124 24012
C2	Electrolytic cap.	40 µF	6.4 V	5322 124 24027
C3	Capacitor	120 p		4822 121 50404
C4	Capacitor	330 p		5322 121 50369
C5	Capacitor	2.2 kpF		5322 121 50415
C6	Capacitor	820 p		5322 121 50368
C7	Capacitor	3.9 kpF		5322 122 30098
R3-8	Potentiometer	1 kΩ		5322 100 10129
R4-9	Resistor	13 kΩ	1 %	5322 116 50522
R5	Resistor	9090 Ω	1 %	5322 116 50537
R10	Resistor	3.32 kΩ	1 %	5322 116 54005
R13-25	Potentiometer	500 Ω		5322 100 10148
R14	Resistor	8.25 kΩ	1 %	5322 106 50979
R15-27	Resistor	1.62 kΩ	1 %	5322 116 50949
R18	Potentiometer	200 Ω		5322 100 10155
R19	Resistor	3.57 kΩ	1 %	5322 116 50614
R20	Resistor	825 Ω	1 %	5322 116 50978
R26	Resistor	5.11 kΩ	1 %	5322 116 50762
R28	Resistor	75 Ω	1/2 %	5322 116 50918
L1-2	Coil			5322 158 10052
L3	Coil	7.44 µH		5322 156 24035

Diagram number	*Description*	*Value*	*W/V*	*Ordering number*
Unit 7				
C1	Electrolytic cap.	20 µF	16 V	5322 124 24012
C2	Electrolytic cap.	40 µF	6.4 V	5322 124 24027
C3-4-7-8-11-12	Capacitor	100 pF		5322 121 54017
C5-9-13	Capacitor	1 kpF		5322 121 50424
C6-10-14	Capacitor	330 pF		5322 121 50369
C15	Capacitor	3.9 kpF		5322 122 30098
R3	Potentiometer	200 Ω		5322 100 10550
R5-6-7-10-17-24	Resistor	2 kΩ	1 %	5322 116 54064
R5-6-7	Resistor	2.21 kΩ	1 %	5322 116 50968
R5-6-7	Resistor	2.43 kΩ	1 %	5322 116 54004
R12-19-26	Resistor	5.62 kΩ	1 %	5322 116 54011
R13-20-27	Resistor	8.25 kΩ	1 %	5322 116 50979
R14-21-28	Resistor	75 Ω	1 %	5322 116 50918
R18-25	Potentiometer	500 Ω		5322 100 10148
L1-2	Coil			5322 158 10052
L3-5	Coil	3.25 µH		5322 156 24036
Unit 8				
C1-2	Capacitor	1 kpF		5322 121 50424
C3-10	Capacitor	1 kpF		5322 122 30027
C4	Capacitor	3.3 kpF		5322 121 54011
C5-6	Capacitor	100 pF		5322 122 30021
C7	Capacitor	4.7 pF		4822 120 10045
C8-9	Capacitor	1 µF		5322 121 40197
C11	Electrolytic cap.	64 µF	6.4 V	5322 124 24072
C12	Electrolytic cap.	22 µF	6.3 V	5322 124 24033
C13	Electrolytic cap.	8.2 µF	16 V	5322 124 10067
C14	Electrolytic cap.	20 µF	16 V	5322 124 24012
R2-11	Resistor	1 kΩ	1 %	5322 116 50573
R10	Resistor	8.25 kΩ	1 %	5322 116 50979
R11	Resistor	1.1 kΩ	1 %	5322 116 50573
R11	Resistor	1.21 kΩ	1 %	5322 116 50965
R17-35	Resistor	10 kΩ	1 %	5322 116 50748
R18	Resistor	15 kΩ	1 %	5322 116 54001
R24	Resistor	3.92 kΩ	1 %	5322 116 50911
R25	Potentiometer	200 Ω		5322 130 10118
R26	Resistor	2 kΩ	1 %	5322 116 54064
R27-29	Resistor	4.75 kΩ	1 %	5322 116 54008
R28	Resistor	2.21 kΩ	1 %	5322 116 50102
R30	Resistor	2.67 kΩ	1 %	5322 116 50784
R31	Resistor	4.32 kΩ	1 %	5322 116 50794
R32	Resistor	511 Ω	1 %	5322 116 50659
L1-L4	Coil			5322 158 10052
Unit 9 (01 version)				
C1-6	Capacitor	1 µF		5322 121 40176
C2-4-7-9	Electrolytic cap.	10 µF	16 V	5322 124 20071
C3-8-19	Capacitor	100 kpF		5322 121 44014
C11-14	Capacitor	22 kpF		5322 121 50287
C12	Capacitor	820 pF		5322 121 50368
C13-15	Capacitor	680 pF		5322 121 50367
C16	Electrolytic cap.	40 µF	25 V	5322 124 24017
C17	Electrolytic cap.	100 µF	10 V	5322 124 24024

Diagram number	*Description*	*Value*		*W/V*		*Ordering number*
C18	Electrolytic cap.	64	µF	16	V	5322 124 24028
R31	Resistor	10	kΩ	1	%	5322 116 50748
R34	Resistor	22.1	kΩ	1	%	5322 116 54003
R39	Resistor	47.5	kΩ	1	%	5322 116 50391
R42	Resistor	100	kΩ	1	%	5322 116 50244
L1-3	Coil					5322 158 10052
Unit 9 (02 version)						
C1-5	Capacitor	1	µF			5322 121 40197
C2-6	Capacitor	150	kpF			5322 121 40307
C3-7	Capacitor	100	kpF			5322 121 40146
C4-8	Capacitor	220	kpF			5322 121 40281
C9	Capacitor	10	kpF			5322 121 40308
C10	Capacitor	22	kpF			5322 121 40085
C11	Capacitor	2.7	kpF			5322 121 54006
C12	Capacitor	1.2	kpF			5322 121 50439
C13	Capacitor	150	kpF			5322 121 50416
C14	Electrolytic cap.	22	µF	6.3	V	5322 124 24033
C15	Electrolytic cap.	8.2	µF	16	V	5322 124 10067
C16	Electrolytic cap.	32	µF	10	V	5322 124 10148
R32	Resistor	8.25	kΩ	1	%	5322 116 50979
R33	Resistor	12.1	kΩ	1	%	5322 116 50572
R32	Resistor	9090	Ω	1	%	5322 116 54148
R33	Resistor	13	kΩ	11	%	5322 116 50522
R32	Resistor	10	kΩ	1	%	5322 116 50748
R33	Resistor	15	kΩ	1	%	5322 116 54001
L1-3	Coil					5322 158 10052
Unit 10						
C1-3	Electrolytic cap.	1250	µF	40	V	5322 124 30069
C2	Electrolytic cap.	2500	µF	25	V	5322 124 30009

XXIII. General information on integrated circuits

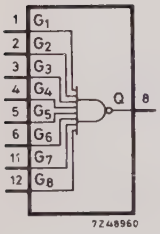
FJ family

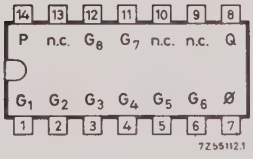
standard temperature range

The FJ family of TTL silicon monolithic integrated circuits is designed for medium speed digital equipment in computing, telecommunication, instrumentation and control.

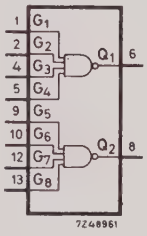
Features of the FJ family: * high-fan-out* low power consumption (typ. 10 mW for standard gates) *high logic swing* low output impedance *short circuit protection *high capacitance drive capability* high noise margin (typ. 1.0 V for standard gates)* comprehensive range of circuits, including NAND gates, AND-OR-NOT, gate expanders, flip-flops and complex-function devices * it corresponds to the 74Nseries TTL. For more specified information on integrated circuits see "PHILIPS DATA HANDBOOK" published by "ELCOMA".

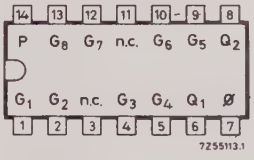
NAND GATES





FJH101





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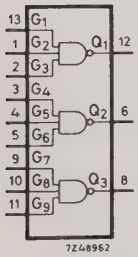

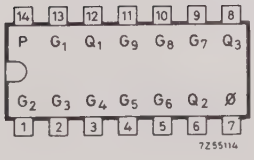

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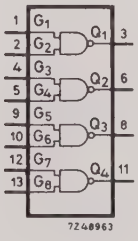
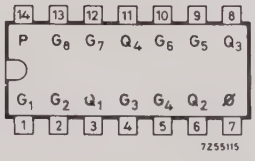
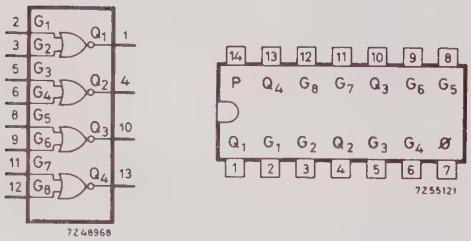




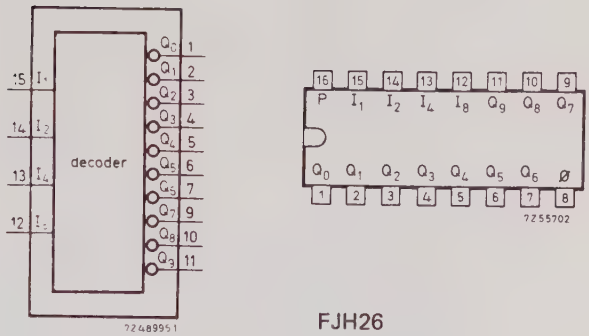
FJH131

QUADRUPLE 2-INPUT NOR GATE



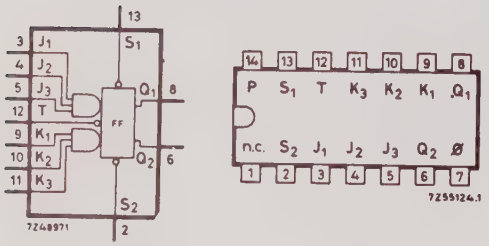
FJH221

BCD-to-DECIMAL DECODER



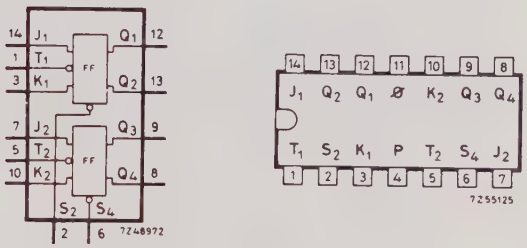
FJH26

SINGLE JK MASTER-SLAVE FLIP-FLOP (AND INPUTS)



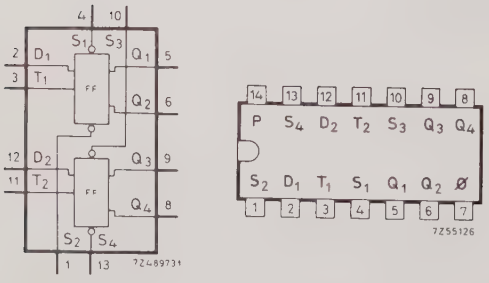
FJJ111

DUAL JK MASTER-SLAVE FLIP-FLOP



FJJ121

DUAL D-TYPE EDGE-TRIGGERED FLIP-FLOP



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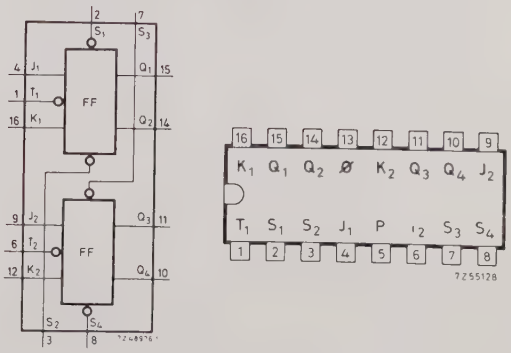
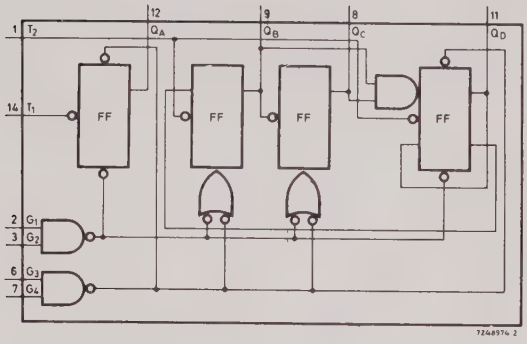
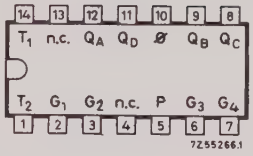
DUAL JK MASTER-SLAVE FLIP-FLOP



FJJ191

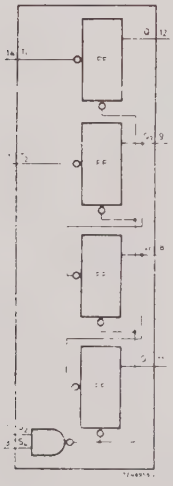
BCD DECADE COUNTER

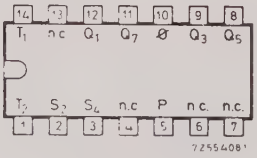




FJJ211

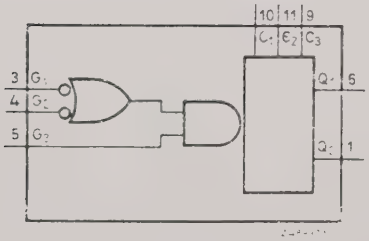
SINGLE ASYNCHRONOUS 4-BIT BINARY COUNTER

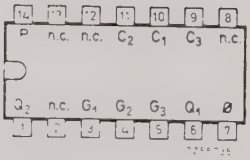




FJJ141

MONOSTABLE MULTIVIBRATOR





FJK101/74121

QUALITY REPORTING

CODING SYSTEM FOR FAILURE DESCRIPTION

The following information is meant for Philips service workshops only and serves as a guide for exact reporting of service repairs and maintenance routines on the workshop charts.
For full details reference is made to Information G1 (Introduction) and Information Cd 689 (Specific information for Test and Measuring Instruments).

LOCATION

□□□
Unit number
e.g. 000A or 0001 (for unit A or 1; not 00UA or 00U1)

or: Type number of an accessory (only if delivered with the equipment)
e.g. 9051 or 9532 (for PM 9051 or PM 9532)

or: Unknown/Not applicable
0000

CATEGORY

□
0 Unknown, not applicable (fault not present, intermittent or disappeared)
1 Software error
2 Readjustment
3 Electrical repair (wiring, solder joint, etc.)
4 Mechanical repair (polishing, filing, remachining, etc.)
5 Replacement
6 Cleaning and/or lubrication
7 Operator error
8 Missing items (on pre-sale test)
9 Environmental requirements are not met

COMPONENT/SEQUENCE NUMBER

□□□□
Enter the identification as used in the circuit diagram, e.g.:

GR1003	Diode GR1003
TS0023	Transistor TS23
IC0101	Integrated circuit IC101
R0....	Resistor, potentiometer
C0....	Capacitor, variable capacitor
B0....	Tube, valve
LA....	Lamp
VL...	Fuse
SK....	Switch
BU....	Connector, socket, terminal
T0....	Transformer
L0....	Coil
X0....	Crystal
CB....	Circuit block
RE....	Relay
ME....	Meter, indicator
BA....	Battery
TR....	Chopper

Parts not identified in the circuit diagram:

990000	Unknown/Not applicable
990001	Cabinet or rack (text plate, emblem, grip, rail, graticule, etc.)
990002	Knob (incl. dial knob, cap, etc.)
990003	Probe (only if attached to instrument)
990004	Leads and associated plugs
990005	Holder (valve, transistor, fuse, board, etc.)
990006	Complete unit (p.w. board, h.t. unit, etc.)
990007	Accessory (only those without type number)
990008	Documentation (manual, supplement, etc.)
990009	Foreign object
990099	Miscellaneous

Sales and service all over the world

Argentina: Philips Argentina S.A., Cassila Correo 3479, Buenos Aires; tel. T.E. 70, 7741 al 7749

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Danmark: Philips Elektronik Systemer A/S Afd. Industri & Forskning; Strandlodsvej 4 2300-København S; Tel (0127) AS 2222; telex 27045

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